Editorial

FROM time to time in the history of radio, some development has taken place of sufficient importance to change entirely the trend of design.

Such landmarks have been few and far between. The last of these was possibly the development of the superheterodyne. It is true that many new valve types have been produced to make such circuits more valuable, but they have not in themselves been much more than an application of techniques already established.

Radio design has always centred itself on valve design. The valve is the key to almost any circuit. The more efficiently it can be made to do its job, the more progress can be made in achieving results more economically and with fewer components.

All this is leading up to some comment on the Transistor "valve" of which mention has been made several times recently. There is a further article on the subject in this issue.

This device seems to promise something which has exercised the engineering mind for years—the filament-less valve. The necessity for heating the primary electron emitter has embarrassed valve designers since earliest times, and is becoming more and more important as valves become smaller and smaller. Moreover, present technique is calling for still more valve elements in the form of numerous "grids," each one of which is a potential source of trouble and extra connection.

The Transistor might well foreshadow the answer to some utterly simple device which is capable of rectifying amplifying, and oscillating without filament power, and without numerous connections. If we agree that a vital component of progress is simplification, this possibility becomes even more attractive.

It has always been a source of regret to me that most of our new radio applications, such as F.M. and Television, are progressively more complicated. Essentially, this complication centres round the fact that there are so many jobs in the circuit to be done that a great many valves must be used. Both these new applications have big promise, and if they can be simplified, as they must be, their usefulness will be increased immeasurably.

At present there are some limitations on the Transistor which prevent its application to some of our most important problems. But I suggest you watch its future very closely, for it may well be the key to big things in the future.

John Moyle

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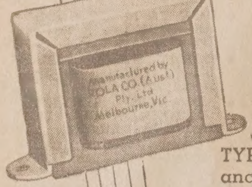
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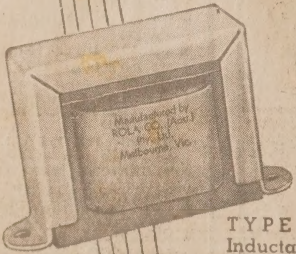
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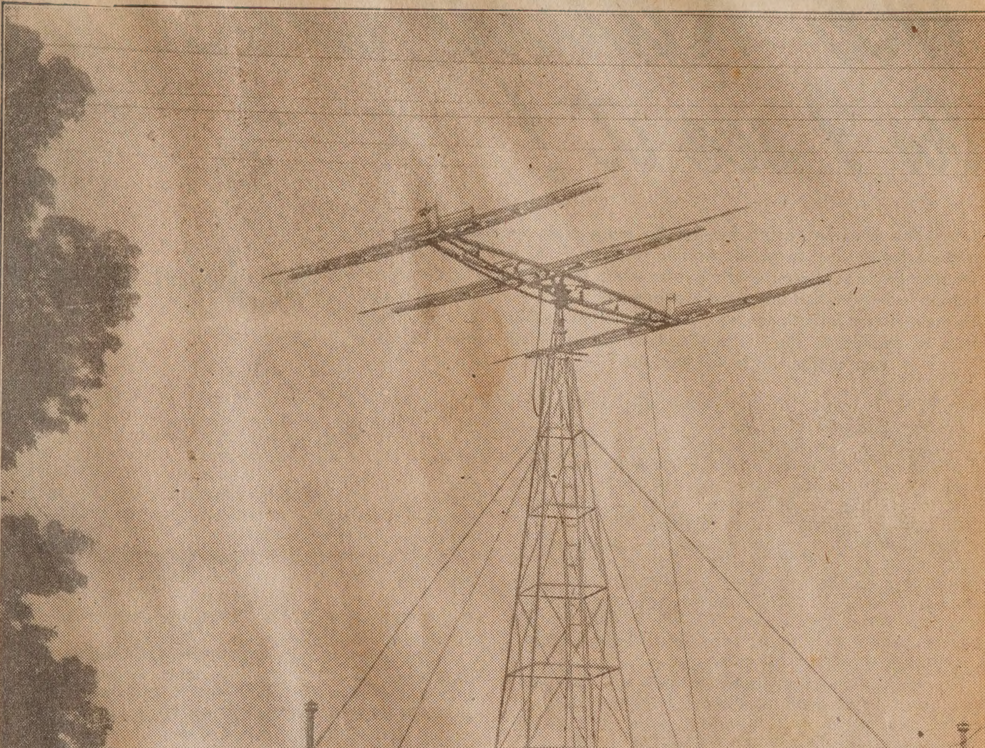

DESPITE their low power rotary beam aerials such as this one enable amateur transmitters to send strong signals all over the world to similar stations in other countries. Specially suited to high frequencies, the beam antenna is symbolical of UHF progress, and in various forms is widely used to concentrate radiated energy in one direction. Aerials such as this are typical of the knowledge and skill of amateurs. It belongs to VK2AJC, Mr. B. J. Eve, Stanmore, NSW.

The Radio Scene As I see it!

I feel the time has come for a little more plain speaking about the outlook for Australian radio. At the moment, F.M. and Television, are causing great confusion in the public mind. This confusion is due to incomplete information as to the Government's plans for radio, its failure to make its full intentions clear, and the natural inability of the average man to appreciate the full implications, technical and otherwise, of a vast subject he is not equipped to understand.

by John Moyle

FIRSTLY I want to say something about the present position of F.M.

Technically, the PMG, under instructions from the Standing Committee on Broadcasting, has completed its preliminary tests with two F.M. stations —one operating in Melbourne with a full-sized aerial, and a similar type in Sydney which so far has operated with a temporary aerial. In the other capital cities more F.M. stations will be erected, to commence a full service when the time comes. Rebroadcasts of ABC programmes are now taking place day and night during the week, and can be tuned in quite well in Sydney and Melbourne by experimenters with F.M. sets.

No one knows when these stations will "arrive." Your guess is as good as mine. I do not think it will happen until well into next year, but on its present form, the Government could no longer surprise me with any announcement about anything.

In any case, broadcasting is only part of the contract. There must be receivers also before any service is a reality.

About two years ago, when I wrote an appreciation of the F.M. and Television outlook, I was taken to task by more than one, because I said that F.M. was not going to be the savior of the radio industry, which for the past two years, has experienced an existence of ups and downs.

What, in fact, has happened since then? To my way of thinking, the radio trade has more or less gone cold on F.M. as a selling feature for sets. The chief executive of at least one big manufacturing concern has been quoted many times as most pessimistic about F.M., if not openly antagonistic. Every engineer I know has stressed the difficulties he is meeting in making F.M. sets which operate as they should, or which can be relied on to give perfect results over long periods.

This should not be taken to indicate that F.M. sets will always be poor in design or in quality. But I have yet to be convinced that, if F.M. services started soon, an adequate supply of good quality receivers would be available.

This is not a slur on Australian engineers. In American journals we read the condemnation of many F.M. sets which are poorly designed and constructed. From the service angle, I think it is fair to say that many are sorry they ever heard of F.M. For there is no doubt that these sets are not easy to make, are difficult to adjust so that the full noise-reduction features may be realised, and are expensive. Moreover, the radio servicing industry is not yet in a position to keep them going.

There is no doubt that eventually these matters will adjust themselves. I am merely recording the position as it appears to me at the present time.

The foregoing remarks are made against the background of F.M. experiments in our own laboratory, and results obtained by others. Briefly, we have found that, with the simple adaptor described in this issue, quite strong signals are obtainable in most parts of Sydney. Musical quality is good provided a first class audio system and loudspeaker is used. Frankly, we have not been able to achieve complete electrical noise suppression, although there is a big improvement over a similar A.M. set operated here in the heart of the city.

I cannot say whether the present F.M. transmissions are as good as they can be, but a direct comparison with a wide-band A.M. tuner and the F.M. tuner played through the same system shows that there is little differ-

F.M.

- Frequency modulation will not and cannot be introduced overnight. It is not practicable to make sudden and sweeping changes in the broadcasting system.
- Therefore your A.M. set is and will be perfectly O.K. for years to come, particularly outside city areas.
- Do not expect too much or too little from F.M. Its value to the broad plan for radio is not merely its superiority or otherwise over A.M. Its future must therefore be considered in this light.
- Keep your eye on future developments, but there is no justification for panic.

ence in quality. Of the two, the A.M. set is much easier and cheaper to build and adjust.

When played through an average audio system and loudspeaker of the mantel variety, results are much the same.

There is only one clear point on which I feel able to advise at the moment, and fortunately, it is being stressed more and more by those who should know. It is that A.M. broadcasting is not likely to go out overnight—in fact it simply could not do so. Whatever is the truth about future broadcasting plans, they give evidence of being so vast and comprehensive that they will take years to have anything like a full effect. The claims of present A.M. set owners to a service are so great that they must carry weight. It is my opinion that no new A.M. set owner will miss very much for years to come if he spends his money now. The position is far too obscure to hold any other view.

For the country listener, once again I say that there seems no alternative to the present A.M. set-up, preferably with a short wave service plan, to reach certain outback areas where broadcast band stations are not heard at their best. The prospect of F.M. in the country areas is way down on the priority list.

POLITICAL ASPECT

Miracles can happen, but in this case, I don't think they will.

Turning to the political aspect of F.M., what encouragement has anyone, manufacturer or buyer, received to date? The future of F.M. could scarcely be more obscure. Statements by Government spokesmen have obviously told only part of the story.

It is due largely to this fact that so many people are being, perhaps, unduly pessimistic about the whole thing. Because there is little doubt that F.M. will be here some day, and will do a good job, if only because it will allow more stations to be operated and greater use to be made of the available channels for broadcasting, both on the A.M. broadcast and the F.M. ultra-short wave bands.

I must remind you that this clearing of channels has always been quoted as one big reason for the ultimate switch to F.M. It follows that all services in the major cities, and some others, must go to F.M. if this goal is to be reached.

But we have been told that F.M. at present is visualised only for the ABC. That means only two stations in each capital city will use it. If the commercial stations, which outnumber the National stations many times, are to stay on A.M., how can these two statements be reconciled?

Either the intention is eventually to allow all city broadcasts to use F.M. or there is some development not yet made clear by the Government which will make sense of this contradiction.

For, as it now stands, listeners can expect to hear only one or two National stations in each city on F.M. sets. If we can accept the fact that the Nationals have only an audience of 10% of total listeners —and no one has disproved this estimate—this new system, which is intended to serve all cities, will in fact serve only a small minority.

It just doesn't add up.

Now we must consider another item of Government policy. This is to set up a Board which will supervise all Australian broadcasting. Exactly what this Board will do is yet another of the tantalising unknowns, but its terms of reference are wide open. It seems certain that complete nationalisation of broadcasting is gradually taking shape. The more so when you remember that the Government has also said that it does not propose to extend or facilitate the extension of commercial broadcasting interests in Australia.

Can it be that this new Board will sooner or later introduce a plan which will in effect make all stations National stations? That present commercial licences, which are current only for yearly periods, will be re-issued on the condition that the stations concerned broadcast precisely the type of material the Board specifies, on A.M. or F.M.? Advertising to be controlled in much the same way, making the entire Australian broadcasting system a fusion between Nationals and commercials.

This might be one way of extricating the ABC from its present financial difficulties, which now seem to be a permanent state of affairs. The ABC news service, established at great cost—so great that many of us have already wondered what its ultimate future would be—could very conveniently serve the whole vast scheme. It would bring you the news through Government-controlled channels, complete with all the propaganda possibilities such a service involves.

I am not at present commenting as to whether all this would be good or bad. It might be very good, but the opportunities for misuse and prejudiced dictation are vast. Already the Government is taking steps to ban opposition political broadcasts. The new Board would have no limits to its powers in this direction.

TELEVISION

As for television, I think it is still so far away, and is likely in its initial form to affect so few, that it is a bad bet for some time. The Government so far has made a move to examine the financial aspects by calling for tenders. It has yet to show us what kind of a programme this country can support, which will encourage us to spend our money. In fact, it has suggested so little of a basic structure for television that I am convinced it doesn't know enough about it. Technically, television is no problem, although it is still more complicated and costly than F.M.—many times over. I just can't see it making much impression here in the measurable future. At the same time, I can see no better alternative to Government action on the present lines. Initially, the problems are much greater than with radio.

Television ★

- In the first stages of examination by the PMG concerning design and cost.
- There are no published plans as yet for the erection of television stations.
- Manufacturers have done little apart from experimental work, and probably very little of that.
- Programmes and administration problems appear to be more important to us than technical difficulties. Costs are likely to be very high.

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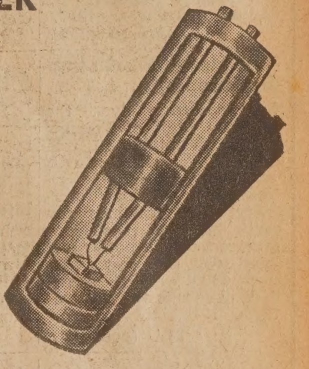
Technical Review

The GERMANIUM CRYSTAL AMPLIFIER

All current American magazines are featuring the Transistor, or crystal triode, developed by engineers of the Bell Telephone Laboratories. A product of pure physical research, this tiny unit, still in experimental form, may prove to be as significant, in radio development, as the early products of Fleming and De Forest.



IN its present experimental form the Transistor is a metal cylinder 3-16 inch in diameter and 5/8 inch long. Inside the cylinder is a block of germanium soldered to a metal disc to which it makes low reistance contact and that grounds it to the cylinder. Two 2-mil tungsten wires make contact with the upper face of the germanium at points about 0.002 inch apart.

An input signal, in series with a small positive bias voltage, is applied between the grounded face and the input "cat whisker" (emitter). A large negative bias voltage is applied between ground and the output (collector) point contact.

DEFINITE GAIN

The output signal appears across a load resistor in series with the negative bias. In this manner a power gain of 100 (20db) is obtained between input and output of a Transistor. The terminal characteristics of an experimental Transistor are shown. This is for an early unit having a gain of about 15db. The characteristics are typical of later units having an average gain of 20db.

Because of its unique properties, the Transistor is destined to have far-reaching effects on the technology of electronics and will undoubtedly replace conventional electron tubes in a wide range of applications. The Transistor requires no heater or filament power and uses the power supplied by its bias sources with high efficiency.

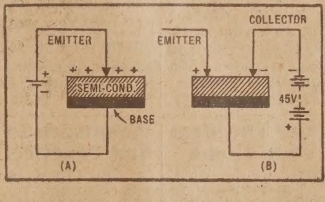
Under typical operating conditions it draws only 0.1 watt from the bias sources (about a tenth the power consumed by a flashlight bulb) and delivers 25 milliwatts of useful output, thus having an overall efficiency of 25 per cent.

The Transistor is smaller than a subminiature vacuum tube. It seems likely to have a useful life of many thousands of hours because of its simple, sturdy construction. Where portability and low battery drain are essential, as in hearing aids and personalised radios, the Transistor appears ideal. It will be useful, too, in equipment using large numbers of amplifiers.

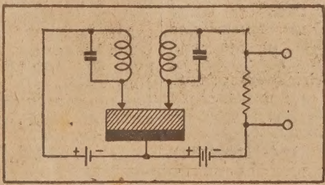
Although cost factors have not been thoroughly explored, Transistors should be no more costly to manufacture at present than the 1N34 germanium diode, the price of which is slightly higher than that of a corresponding vacuum diode (6H6).

Ultimately they should be cheaper than comparable vacuum tubes because of their simplicity and because they do not require evacuation, which is the most difficult step in producing vacuum tubes.

There are limitations to the use of Transistors in their present state of development. The power output is restricted to about 25 milliwatts per unit, or 50mw from a push-pull stage. A Transistor capable of developing several watts output does not seem feasible at present. Parallel operation of two or more units is possible however.



Illustrating the action of the transistor as an amplifier.



Transistor replaces an oscillator valve. Note the unusual polarity of voltages.

The upper frequency of operation is limited to about 10 megacycles by transit time within the germanium. Thus the Transistor is at present useful at audio, video, and the lower radio frequencies, but is unsuited to vhf and uhf applications. Furthermore, the noise generated within a Transistor is appreciably greater than that produced in vacuum triodes.

There remains a temporary obstacle to their immediate use, namely engineering this new device into the circuit. One of the principle problems requiring development is matching the input and output impedances of the Transistor to the circuit. The input impedance of the Transistor is low because the bias in the input circuit causes current to flow in the forward direction through the point contact of the emitter.

OUTPUT IMPEDANCE

On the other hand, the output impedance of the Transistor is about a hundred times higher than the input impedance because its bias causes current to flow in the reverse direction, through the point contact of the collector.

These impedance levels are the opposite of those for vacuum tubes and require a new approach to the coupling circuits between amplifier stages.

In announcing the Transistor, BTL scientists demonstrated several typical electronic devices in which it was used. A booster amplifier for telephony illustrated its application to voice-frequency amplification. A similar video amplifier was also demonstrated.

Use of a Transistor as an oscillator

PRACTICAL BOOKS for the HANDYMAN!

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19/6 (post 5d).

The Marvels and Mystery of Science.

2.—This book contains amazing facts and secrets of the sun, moon, stars, planets, comets, time, space, gravity, temperature, atmosphere, fire, water, heat, light, sound, electricity, magnetism, and all the marvellous machines and mechanisms they involve. 384 pages, nearly 400 amazing photographs and explanatory diagrams.

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Complete Book of Modern Crafts.

3.—By H. Atwood Reynolds. Here is a comprehensive, up-to-date book of home crafts which has been designed for adult use as well as boys and girls. All the most popular crafts are covered thoroughly and in a practical workable way. 305 pages, with many illustrations and carefully made diagrams. 1940.

7/- (post 6d).

New Home Workshop Encyclopedia.

4.—Prepared by the Editorial Staff of Popular Science Monthly. In this amazing volume you will find complete, detailed information, working diagrams and drawings for every sort of craftwork project for both power and hand tools. 580 pages with over 1500 working drawings, diagrams and illustrations. 1944.

21/- (post 10d).

Adventures in Scrap Craft.

5.—Written and illustrated by Michael Carlton Danks, instructor in Educational Handicrafts. This book is intended to inspire home craftsmen to make toys, gifts and other useful and attractive articles for their family and friends. 1st edition. 376 pages, fully illustrated. 1946.

28/- (post 8d).

The Australian Carpenter.

6.—By C. Lloyd, Instructor at Swinbourne Technical College, Glenferrie, Melbourne. A book for the handyman to consult for the hundred-and-one jobs that crop up about the house—for the apprentice in carpentry—and for the fully fledged carpenter. 1st edition. 206 pages, 95 illustrations. 1948.

12/6 (post 6d).

How It Is Made.

7.—By Ellison Hawks. Over 100,000 words and more than 400 explanatory photographs, drawings and diagrams reveal hundreds of interesting facts dealing with engineering and mechanics, science and building — from a giant ocean liner to a radio valve, from a bomber to a gramophone record. 384 pages. 1946. **12/6 (post 8d).**

The Practical Home Handyman.

8.—With a special section on the care and maintenance of your automobile. Edited by Stacy Maney. This is a "must" book for everyone interested in the care and preservation of his home, his furnishings and his car. 304 pages, fully illustrated. 1945.

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The Handyman's Complete Self Instructor.

9.—Covers every practical job from house repairs and renovations to mending your own shoes — from making a kitchen dresser to repairing an alarm clock —from papering a room to mending your radio. 576 pages, nearly 600 illustrations. **12/- (post 8d).**

Model Railway Hobby.

10.—By M. H. Binstead. In this book the author deals at length with such questions as track laying, layout planning, construction of science work, signal operation and even photography of models. 1st edition. 268 pages, 120 figures. 1948. **16/6 (post 4d).**

Gifts You Can Make Yourself.

11.—Illustrated. A delightful all-family gift book with easy-to-follow instructions and diagrams for making over 150 gifts in needlework, knitting, carpentry and crafts. 256 pages, with photographs and explanatory diagrams.

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The Make-It-Yourself Book of Handicrafts.

12.—By Henry H. Walsh. This book will show you how to make any number of useful and beautiful things with your own hands. With these easy-to-follow directions—specially written and illustrated for the beginner — everyone could master one or more crafts. 278 pages, over 300 illustrations and diagrams. 1946. **7/- (post 6d).**

How To Get The Most Out Of Your Home Workshop

13. — Prepared by the Editorial Staff of Popular Science. All the home craftsman needs to know about the use of hand and power tools in his own home. A gold mine of woodworking ideas for both beginner and expert. 1st edition. 184 pages, over 750 illustrations. 1946.

14/- (post 6d).

Woodwork In Theory And Practice.

14.—By John A. Walton. The various chapters deal with tools, processes, fundamental construction, hardwood, timbers, wood turning, inlaying veneering, wood polishing and projects. 1st edition. 299 pages, over 800 detailed sketches illustrating all phases of the work, including all the common hand woodworking tools. 1947.

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Build A Boat For Pleasure Or Profit.

16.—Published by Popular Mechanics Magazine. Includes row boats, canoe, power and sail craft, plywood, outboard, cabin cruiser and many interesting projects for the boatman. 192 pages, many illustrations and diagrams. 1941.

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CRYSTAL AMPLIFIER — *Continued*

showed the versatility of the unit. Use in a radio receiver for the standard broadcast band illustrated its practicality.

The radio receiver contained no tubes. It consisted of a broadband R.F. amplifier, a tuned R.F. stage, local oscillator, mixer three stages of I.F., second detector, and four stages of A.F. amplification, the last being push-pull. A total of 11 Transistors was used in the amplifier stages, with 2 germanium diodes for the mixer and detector stages, and 2 selenium rectifiers for the power supply. The receiver brought in local stations, delivering 50mw of audio power to its loudspeaker.

NO FILAMENT

Transistors, having no filament, are operative the instant power is applied.

The transistor is the outgrowth of experiments and theoretical studies of semi-conductor phenomena by Dr. William Shockley, of the Bell Telephone Laboratories, assisted by Drs. Walter Brattain and John Bardeen.

In critically examining the implications of the prevailing theory of electrical conduction in semi-conductors, Dr. Shockley was able to predict that it should be possible to control the meagre supply of electrons inside a semi-conductor by influencing them with an electric field imposed from the outside without actually contacting the material.

Realising the practical implications of such a possibility he devised some experiments to test his hypothesis, but was unable to secure positive results. The electrons seemed to get trapped in the surface of the material and did not behave just as anticipated.

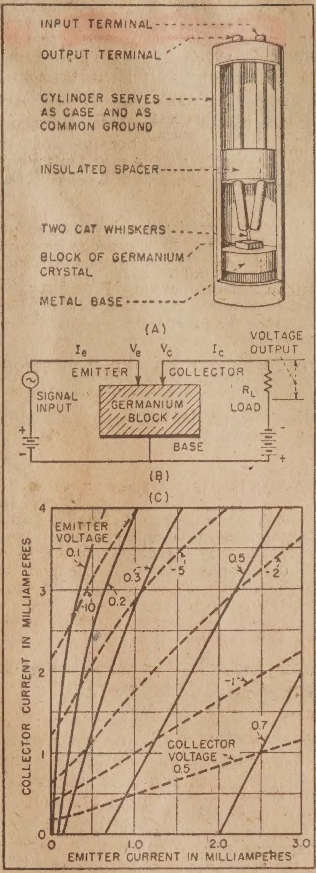
This part of the problem was tackled on a theoretical basis by Dr. Bardeen. He developed a theory of what happened at the surface which was able to explain satisfactorily many of the observed facts and which led to further experiments carried out in collaboration with Dr. Brattain. In the course of these experiments they invented transistors.

CURRENT FLOW

Transistor action depends upon the fact that electrons in a semi-conductor can carry current in two distinctly different ways. This is because most of the electrons in a semi-conductor do not contribute to carrying the current at all. Instead they are held in fixed positions and act as a rigid "cement" to bind together the atoms in a solid. Only if one of these electrons gets out of place, or if another electron is introduced in one of a number of ways, can current be carried.

If, on the other hand, one of the electrons normally present in the cement is removed, then the "hole" left behind it can move like a bubble in a liquid and thus carry current.

Figure 1 represents a cross-section of a germanium crystal with a positive voltage applied through a point contact (the emitter).



Illustrating (A) the construction of an experimental transistor (B) its connection into an amplifier circuit and (C) the characteristics that produce good amplification.

The current flow under this condition does not fan out from the emitter contact points through the body of the crystal material to the base, but instead spreads out widely over the surface of the crystal somewhat like water spreads out on top of a non-porous surface such as glass. This current flow across the surface is carried by the holes.

The amplification process can be understood in terms of the discovery that the emitter point is surrounded by an "area of interaction." Within this area the electronic structure of the semi-conductor is modified by the input current.

Now, if the output point (the collector) is placed in this area and a negative bias applied to it, the output current can be controlled by the input current. This control of output current by input current is the basic mechanism of amplification. The optimum spacing between the emitter and the collector is about .002 inch. Increasing the space decreases amplification. The "area of interaction" extends out to a distance of about .01 inch from the emitter point.

ATTRACTS "HOLES"

If the negative collector bias is made large enough to make the collector current equal to, or larger than the emitter current, the polarity of the collector bias will attract the holes flowing from the emitter. Then a large part of the emitter current flows to (and enters) the collector. While the collector has a high impedance to the flow of electrons into the crystal semi-conductor, there is little opposition to the flow of the holes into the collector point.

If the emitter current is varied by feeding in an a-c signal, the collector current varies correspondingly. The flow of holes from the emitter to the collector may alter the normal current flow from the crystal base to the collector in such a way that the change in collector current will actually be larger than the change in emitter current; in effect amplification.

PULSED-LIGHT SURVEYING IDEAL FOR RUGGED TERRAIN

SURVEYING by pulsed light is possible when conventional methods are too slow or when long traverses over inaccessible terrain are needed. An optical-electronic instrument determines distance by measuring transit time of light pulses travelling to and from a retrodirective reflector. Accuracy compares favorably with that of a third-class survey.

The unit consists of optical head, oscilloscope, power supply, and converter. The optical head, mounted on a tripod, contains a flash lamp and parabolic mirror. When lamp is flashed, the mirror directs light on the reflector set up at the point, the relative position of which is to be found.

At the same time, a sweep generator is triggered, causing a trace to appear on the cathode-ray tube. On returning to normal state, the sweep generator triggers a second sweep timer, which gates the range and trigger pip generators. These produce a second trace displaying range pips.

The light reflected back from the cube-cornered target reflector is focused on the cathode of a photomultiplier. Output of the photomultiplier is amplified and fed through a delay line to the oscilloscope where it is amplified by two additional stages to produce a vertical pip on the cathode-ray tube.

Adjusting a phase shifter for oscillator output matches range and target return pips. Oscillator frequency is such that the interval between successive ranging pips corresponds to a 500-yd. interval. Range dials then show the desired distance reading.

RED LINE

TRANSFORMERS of DISTINCTION

HEAVY DUTY AMPLIFIER TYPE

The transformers listed in this section comprise a wide range of types suitable for practically any circuit requirements. Careful attention has been given to their design and construction to produce robust, economical and reliable units of maximum dependability.

Temperature rise conforms to accepted practice for electrical apparatus of this nature, and will not exceed 35-40 degrees Centigrade for continuous operation under full rated load. Unless otherwise stated, current ratings are based on their use in choke input filter circuits, and while insulation is ample to cover the added peak voltages involved in condenser input systems, H.T. secondary current ratings should be reduced by approximately 20% to allow for the severe heating effect due to the poor form factor of rectified current. The approximate DC voltage available at the input to the filter system is given for rectifier valves normally used.

All Red Line units are baked and impregnated with super insulating varnish and are specifically made for use under adverse climatic conditions.

Item 11. **TYPE No. 15353.**

Prim: 200-230-240v. .. .. 110vA. .. .. 50 cps
H.T: 350 CT 350v. 150mA. Cond. Input.
Fils: 5v-3A 2.5v-5A 6.3v-3A
Base: 4½ x 4 x 4¼" H. .. .. Wgt. 9lb. 4ozs.
Mntg: V11 .. .. "S" is 2⅛"

D.C. Volts	Choke Input	Cond. Input
5V4	285v	350v
83	290v	
5Z3	260v	350v

Item 12. **TYPE No. 15403.**

Prim: 200-230-240v. .. .. 110vA. .. .. 50 cps
H.T.: 400 CT 400v. 150mA. Cond. Input.
Fils: 5v-3A 2.5v-5A 6.3v-3A
Base: 5 x 4½ x 4¾" H. .. .. Wgt. 10lb. 12ozs.
Mntg: V15 .. .. "S" is 1¾"

D.C. Volts	Choke Input	Cond. Input
5V4	320v	405v
83	335v	
5Z3	290v	400v

Item 13. **TYPE No. 20353.**

Prim: 200-230-240v. .. .. 140vA. .. .. 50 cps
H.T: 350 CT 350v. 200mA. Cond. Input.
Fils: .. .. .. 5v-3A 2.5v-10A CT 6.3v-3A.
Base: 5 x 4¾ x 4¾" H. .. .. Wgt. 12lb. 8ozs.
Mntg: V15 .. .. "S" is 2"

D.C. Volts	Choke Input	Cond. Input
5Z3	240v	320v
83	300v	

Item 14. **TYPE No. 17503.**

Prim: 200-230-240v. .. .. 145vA. 50 cps
H.T: 500 CT 500v. 175mA. Cond. Input.
Fils: .. .. .. 5v-3A 6.3v-3A 6.3v-2A.
Base: 5 x 4¾ x 4¾" H. .. .. Wgt. 12lb. 8ozs.
Mntg: V15 .. .. "S" is 2"

D.C. Volts	Choke Input	Cond. Input
5V4	410v	470v
83	425v	
5Z3	375v	480v

Item 15. **TYPE No. 20453.**

Prim: 200-230-240v. .. .. 150vA. .. .. 50 cps
H.T.: 450 CT 450v. 200mA. Choke Input.
Fils: .. .. .. 5v-3A 6.3v-3A CT 6.3v-3A.
Base: 5 x 4¾ x 4¾" H. .. .. Wgt. 12lb. 8ozs.
Mntg: V15 .. .. "S" is 2"

D.C. Volts	Choke Input	Cond. Input
83	380v	
5Z3	345v	460v
5V4	340v	450v

Item 16. **TYPE No. 25503.**

Prim: 200-230-240v. .. .. 190vA. .. .. 50 cps
H.T.: 500 CT 500v. 250mA. Choke Input.
Fils: .. .. .. 5v-3A 6.3v-3A 6.3v-3A.
Base: 5⅜ x 5 x 4¾" H. .. .. Wgt. 15lb. 8ozs.
Mntg: V15 .. .. "S" is 2½"

D.C. Volts	Choke Input
5Z3	355v
83	400v

Item 17. **TYPE No. 25563.**

Prim: 200-230-240v. .. .. 200vA .. .. 50 cps
H.T.: 565 CT 565v. 250mA. Choke Input.
Fils: .. .. .. 5v-4A 6.3v-3A 6.3v-3A.
Base: 5⅜ x 5 x 4¾" H. .. .. Wgt. 15lb. 8ozs.
Mtng: V15 .. .. "S" is 2½"

D.C. Volts	Choke Input	Cond. Input
83	475v	
5Z3	430v	
5R4GY	430v	600v

Item 18. **TYPE No. 5176.**

Prim: 200-230-240v. .. .. 240vA. .. .. 50 cps
H.T.: 730 CT 730v. 200mA
330 CT 330v. 100mA
Fils: 5v-3A 5v-2A 6.3v-3A 6.3v-4A
Base: 4 x 5¼ x 5¾" H. .. .. Wgt. 16lb. 12ozs.
Mntg: V12 .. .. "S" is 3"

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A GUARANTEE OF DEPENDABILITY

LATEST C.R. TUBE AMPLIFIES LIGHT

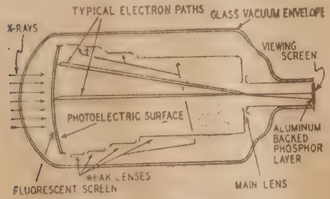
Developed by the X-Ray Division of Westinghouse at Baltimore, US, a new C.R. tube speeds up and simplifies X-Ray examinations. It does this by amplifying electrically the normal fluorescent pattern.

Dr. J. W. Coltman of the Westinghouse Laboratories adjusts the focus with a magnet.

THE sketch shows how the magnifier tube works. X-rays, which have passed through the patient's body, just as in a standard fluoroscope, strike a fluorescent screen.

Behind this screen, on which is produced the image of the patient's organs, is a layer of photoelectric material. Each point on the photoelectric surface emits electrons in direct proportion to the brightness of the segment of the fluorescent screen facing it.

The electrons emitted by the photoelectric surface are accelerated and focused by the electronic lenses, to which a high potential is applied. They strike a second fluorescent screen at the small end of the tube.



X-Rays strike the fluorescent screen, releasing electrons which are accelerated by the lenses, striking the smaller screen with great velocity and making a brighter image.

Here the image is much brighter than on the original fluorescent screen for two reasons. First, the acceleration of the electrons has caused them to strike the small screen with great force. This gives a brightness gain of 20 times.

Second, reduction of the image on the small screen to one-fifth the size of that on the large screen increases the brightness. The image size is reduced by a factor of 5 and the brightness is increased by the square of 5 or 25.

Combining the two increases in brightness, the total brightness gain is 500. By using an ordinary optical magnifying lens system to examine the small screen, the physician sees the image effectively in its original size.

The conditions that confront the physician in present-day fluoroscopy are trying. He has to dark-adapt his eyes for twenty minutes to see the fluoroscopic image.

With the image amplifier tube attached to his euipment, the physician will step into his dark room and see at once an image almost as bright as on a movie screen. He may still have to dark-adapt his eyes, though for only three or four minutes, before he can see all the details. What he sees after that will be a clear, easily discernible feature presentation of his patient's organs at work.

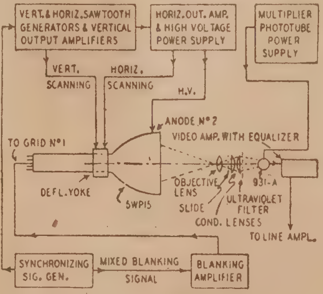
The future possibilities for amplified fluoroscopy are impressive. Both patient and doctor will save time, and cut down on the period during which they are exposed to direct and scattered X-rays. Even televising fluoroscopic images may well become practical. The physician will be able to perceive objects at present indiscernible.

The image amplifying system is just emerging from the research stage. Westinghouse engineers warn that many months of perfection and design engineering remain to be done before the device is commercially available. The research has, however, irrefutably proven that it is practical and important.

AN ELECTRONIC FLYING SPOT

TELEVISION station call letters, test patterns, and pictorial programme material may be broadcast, without using expensive and elaborate studio cameras, with the help of the recently designed "flying-spot" cathode-ray tube. Any transparent or opaque slide can be transmitted with the half-tone fidelity of photographic film.

The new tube is not a camera tube, but is a source of light, and is very much like an ordinary cathode-ray picture tube. The extremely intense spot of light which travels over its face is projected through a transparent slide containing the picture. As the spot scans the slide, the light variations produced by the picture are picked up by a multiplier photo-tube and transmitted as video signals.



Block diagram of flying-spot system.

The tube, designated 5WP15 by its makers, the Radio Corporation of America, is about 11½ inches long, and the flat fluorescent face is five inches in diameter. The diagram shows how the tube is operated to transmit the picture from a transparent slide. The spot travels just as in the standard television system—525, lines interlaced, 30 frames.

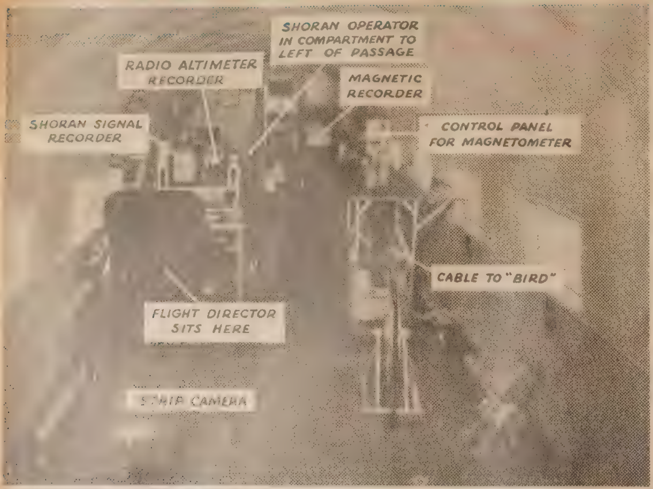
The flying-spot principle is not new—it was one of the first systems of television transmission used in experiments. A rotating disc and light source produced the flying-spot. Until the development of the new 5WP15, however, an all-electronic flying spot was not used, due to several operating difficulties.

One of these troubles was "trailing." When a cathode-ray tube is made with most ordinary phosphors, there is an appreciable time delay in the build-up and decay of light. The light builds up only gradually, and the received picture outlines are blurred—the black areas trailing over into what should be a white area.

Decay of light on a particular spot of the tube face also took time with the old-style cathode-ray tubes. The white in the received image tended to trail over into the black.

The new flying-spot tube uses a phosphor known as P15, which has extremely short persistence, to reduce trailing. In addition, most of the light emitted is near the ultra-violet region, in which persistence is much shorter than in the visible region. This reduces the trailing further.

MODERN SCIENCE SEARCHES FOR OIL


SHORAN OPERATOR IN COMPARTMENT TO LEFT OF PASSAGE
RADIO ALTIMETER RECORDER
MAGNETIC RECORDER
SHORAN SIGNAL RECORDER
CONTROL PANEL FOR MAGNETOMETER
CABLE TO "BIRD"
FLIGHT DIRECTOR SITS HERE
STRIP CAMERA

Interior of aircraft fitted out for oil survey by magnetometer in the Bahamas.

The rise of the petroleum industry has perhaps been one of the most spectacular developments in industrial history. So vast has been the usage of oil and its products that the world now seems faced with a shortage of this very essential commodity.

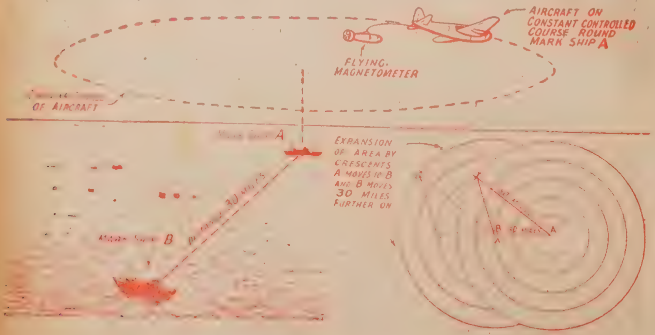
THE peacetime use of oil is very great in a world rapidly becoming more and more industrialised. With the mechanisation of war, the problem has become more urgent. The enormous wastage of oil for purposes of destruction has produced the paradoxical situation where man has barely enough oil to help build up again what he has smashed down. It will be ever thus while man remains man.

So it is that men all over the world are feverishly searching all likely spots where oil might be found. They are making hazardous journeys through jungles and infested swamps. Exploring comparatively unknown territories. Searching along the bottom of the oceans and lakes.

In all lands diplomacy includes the acquisition of oil concessions, and nations hate each other for it, and make war for it. Vast international financial organisations are joined in combat for it, and make it the centre for all manner of intrigue. This, then, is OIL.

SUBSTITUTE

There have been many attempts to find substitutes for natural petroleum, such as the extraction of oil from coal and shale. These attempts have been partially successful, but do not seem to have added greatly to the world's supply. The processes are also comparatively expensive, both in plant and technique, and are not a satisfactory substitute for the natural product.


AIRCRAFT ON CONSTANT CONTROLLED COURSE ROUND MARK SHIP A
FLYING MAGNETOMETER
OF AIRCRAFT
A
EXPANSION OF AREA BY CRESCENTS A MOVES TO B AND B MOVES 30 MILES FURTHER ON
30 MILES
B
B
A

Shoran (short range radar) pin points aircraft position during flight. Bottom right—the circular flight of the surveying aircraft.

Most estimates of the oil reserves of the world are based on the oil available using present methods of production. These estimates show a declining yield, and the question, therefore, resolves itself into one of keeping on with the present oil recovery methods, finding new fields, improving the methods of recovery, or perfecting the processes of oil recovery from shale and coal.

It is safe to say that there are many billions of gallons of oil in the earth which can be recovered by secondary recovery methods. These are methods other than pumping.

FAILING PRESSURE

As with most things, oil is primarily recovered for profit and, when the oil well owner ceases to make a profit, he closes up and seeks other fields, regardless of the consequences to the nation. The point where he closes up is usually when the pumps cease to produce oil at a profitable return.

In most cases the oil has not been exhausted. It has merely ceased to flow because the gas or water pressure at the bottom of the well has dropped to too low a level to force the oil from the retaining sand.

Several methods have been developed for recovering the residue of oil from an "exhausted" well. Compressed air has been forced into the bottom of the well. Water under pressure has been used, and chemicals introduced. Even with these methods, which have been successful up to a point, there is still a large quantity of oil left in the sand.

RANNY PROCESS

An interesting process of secondary oil recovery is that developed by Leo Ranny, an American engineer. This process is now being used in other parts of the world, including Australia.

The process consists of sinking a normal shaft, similar to a shaft on the coalfields. At the bottom of the shaft is a workroom containing horizontal drilling machines, which are capable of drilling horizontally into the oil-retaining earth structure to a distance of some 4000 feet. These holes are drilled outwards, with the workroom as a centre, and radiate from the workroom in all directions. The oil seeps through the holes into a well under the workroom, whence it can be pumped to the refineries.

A method of recovering the residual oil in oil sands has been developed in France, and is even more like coal-mining than the method just described.

Shafts are sunk until the oil re-

TO SATISFY WORLD'S NEW DEMAND

by Calvin Walters

taining sand is reached, perhaps well over 1000 feet below the land surface. Horizontal galleries are then made above the oil sand, and from these again vertical shafts are sunk into the sand. Oil from the sand seeps into the wells, which are dug at numerous points along the horizontal gallery.

Approaching the coal-mining technique a little closer is a process now being used on the Continent of Europe. Ordinary shafts are sunk into the oil sand. Excavating machinery and skips are then used to dig the sand and bring it to the surface, where it is treated with chemicals.

It has been established that more oil is left in the ground than is removed by pumping, so that any process which enables the oil sands to be removed for treatment must be very valuable. It is the heavier oils that mostly remain in the sand and, with this kind, up to 90 per cent of the available oil is retained.

NEW FIELDS

Meanwhile, in conjunction with the new methods, new oil fields are being opened up. Activity exists everywhere to place oil searching on a more scientific basis. Deeper and deeper wells are being dug, even down to 15,000 feet.

Crude oil exists in sedimentary rocks in practically all kinds of geological formation, with the exception of the very earliest and latest. The old haphazard drilling by prospectors on the strength of a "hunch" or the film of oil floating on the surface of a pond, has become obsolete, being far too costly and uncertain.

Oil is often found permeating the texture of porous sandstone with a base of water under pressure or natural gas. Pockets of oil containing many millions of gallons are sometimes sealed by overlying domes of impervious rock. When these are drilled into the water or gas pressure beneath forces up the oil into a "gusher."

Oil is found at varying levels up to 3000 feet and these levels may vary even on the same field.

It is obvious that oil searching requires highly skilled and scientific methods if it is to be at all efficient and successful.

THREE FACTORS

The latest methods make use of three main factors. The gravitational pull of buried rock formations. The variation of the magnetic attraction of different kinds of rocks and the reflection of seismic waves from varying rock formations.

Experience has given to scientists the information required as to the geological formation of rocks and sediments in areas where oil is likely to be found, so that any method which will map out the underground formations is of great value. The methods to be mentioned do this.

When a buried rock formation is denser than the material in which it is embedded it will have a greater gravitational pull than the surrounding medium. The instrument used to detect this pull is called a gravimeter.

It consists of a mass of metal suspended by a spring. Any additional pull by gravity on this sprung mass will cause an increase in the length of the spring which is magnified by levers and an optical system. The meter is contained in a housing which is maintained at a constant temperature, so that atmospheric variations have no effect.

THE GRAVIMETER

The gravimeter can measure changes of one part in ten million of the gravitational pull of the earth, and it has been found that a change in pull of ten times this amount may be due to a "dome" or a buried limestone formation which often acts as an oil reservoir.

Thousands of feet below the upper crust of the earth which consists of sediments like limestone and shale, we find the "basement" which consists of the more highly magnetised rocks such as granite and so forth. These cause changes in the magnetic force over the earth's surface which can be detected by means of the land magnetometer.

This instrument consists of a sensitive needle balanced by a weight, and lying horizontally. Magnetic changes cause the needle to dip and the amount of dip is proportional to the changes in the vertical magnetic force. The instrument can measure changes of one part in 20,000 of the vertical magnetic force.

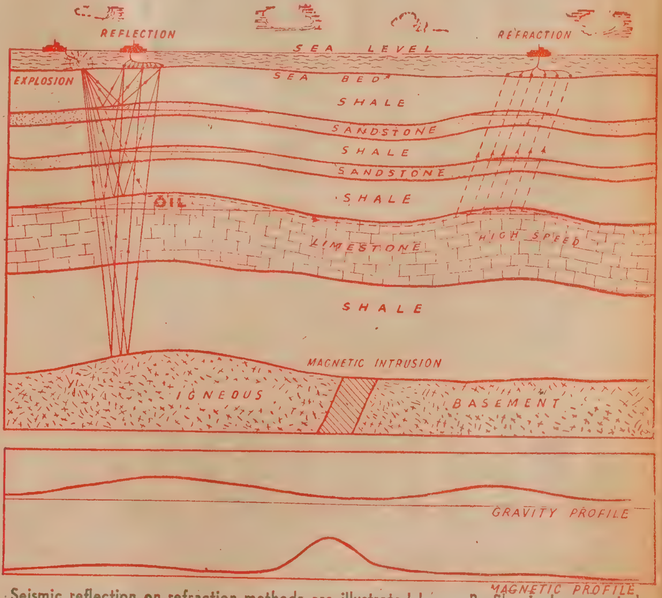
When this instrument is carried over a field the amount of deflection enables the scientist to estimate the depth of the "basement" by comparison with known standards, and thus determine the possibility of oil being found. For instance if the basement is comparatively close to the surface, with only a thin covering of sediments, the chances of oil being found are considered to be poor.

SEISMIC WAVES

A very interesting method of oil prospecting makes use of artificial seismic waves. It involves boring a hole in the ground and exploding a charge of dynamite in the upper part of it.

Sensitive geophones are placed at

(Continued on Page 19)



Seismic reflection on refraction methods are illustrated here. Profiles to be expected are shown in the bottom diagram.

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POPULAR SCIENCE DIARY

By PROFESSOR A. M. LOW,
ENGLISH WRITER,
SCIENTIST

Nature demands constant change to secure life. I have a garden in which grass seeds were planted to a cost of a week's earnings. I found that the net result in no way resembled the illustration upon the packet; indeed I have produced a crop of food which only appeals to the type of animal I never patronise.

LET me save you the trouble of suggesting that I have any personal use for thistles!

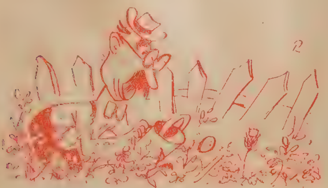
I have watched these things, I mean the thistles, not the donkeys, and I find that it takes countless thousands of seeds to produce one really good thistle on a bare patch of land.

The interesting thing is that this seems a similar manner in which the human stomach is employed. Here we have unbelievable wastage, but as in the case of more quickly living creatures the means provided to secure this wastage are of unlimited complication.

Just imagine all the functions which are necessary for you yourself to secure that out of every two lettuces you eat the microscopically useful portions shall be extracted.

Then think of the wonderful fashion in which some seeds are supported by a parachute-like structure which possesses all the attributes of a well designed girder bridge, so that the wind can be quite sure to remove the seed without fracture.

To our ignorant minds, it seems strange that so delicate a mechanism should be necessary to secure an end through a whole series of wasteful processes, and it is for this reason that I always feel that waste cannot really exist other than in our ignorant mnids.



Then we realise with the physicist that matter is indestructible and begin to think what part is played by fertilisation, and what would be the characteristics of the ultimate thistle were specialisation to take place instead of casual dissemination?

We believe that the answer to this problem is indicated by creatures like the elephant and giraffe which have specialised in order to retain life within their fold and which, in consequence, are definitely dying out.

So, surely science should tell us how we can accelerate, not direct, the processes of nature and devise a method of breeding from both plants and animals which gives us selection without extinction. Dr. Voronoff found one answer.

AN amateur inventor, and they are the best, telephoned me to say that he had found how to light gas fires without matches. He then proceeded to describe the well-known device of a very, very fine platinum wire carrying at intervals little blobs of spongy platinum.

It is, of course, an example of catalytic action and I tried to explain this when he asked me if the result was due to friction and what would be the cost of 20 or 30lb of the material.

WHAT PRICE PLATINUM?

I pointed out that he might have to arrange another lease-lend loan before he could supply many people with a few yards of heavy platinum rod, and then I told him how this principle has been applied to mines and even to submarines.

The great trouble always used to be that hot gases or hydrogen gases in mines disturbed gas indicators as much by their temperature as by their chemical composition.

The problem was solved by making a balanced indicator using one platinum wire and one glass wire. Both expand at the same rate, so only a difference in expansion due to the presence of escaping gas would cause the bell to ring. Platinum was always used for sealing in glass tubes before new alloys were discovered for expanding at the same rate, so that no cracking would occur.

BURN IT TWICE

IT is astonishing how uneconomical we are in order to satisfy our demands for savagery. Look at the way we chew half-raw steaks and choose live fish. Is this not a throwback to animalism? Certainly it is very wasteful.

A coal fire is abominably destructive of many hundreds of valuable medicaments, oils, scents, tars, lipsticks and many other things.

I saw the result, a few years ago, of some experiments made on the incubation of chickens, and it was well established that more lived when warmed by coal fires. No doubt something to do with the variations of temperature which encouraged the chicken to harden itself, as under natural conditions when the mother leaves the nest.

Think of the common candle. Light it and place a small tube with one end at the centre of the flame and the other end sticking outside the flame by a few inches.

You will find you can light the gas which comes off the flame centre because it is just unburned hydrocarbons, most of which go to waste. It was perhaps a little test like this which resulted in the incandescent mantle.

PEACE FROM SUBMARINES

THIS peace has nothing to do with the excellent scheme which Russia has brought out for opening new trade routes under the sea. I am thinking of the queer cellular, putty-like plaster with which German submarines were covered at one time in order to keep in the oscillations of sound so that the noise, or even voices, could not be picked up by electric listening-gear situated in anti-submarine vessels.

A very similar plaster can be spread on roofs, ceilings, and walls Even on to girders. The idea is to prevent the appalling concatenation of loathsome noise from which we all suffer. How I wish we could teach everyone that no one wants their noise! Voice is largely used to express thought. Do I wish, other than in a few cases, to sense everybody's thoughts? You may say that they would do me good. Maybe, but I cannot shut my ears, and we all know that there are occasions when to shut the eyes is a matter not only of policy but of good manners.

COLORED FIRE

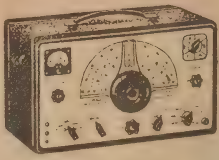
NOT so long ago I happened to witness a number of fires all round me.

It is interesting to think that by touring London at such a time with an instrument consisting of little more than a prism made from an old-fashioned chandelier or a cheap lens, one could estimate the nature of all the materials on fire.

I was amazed, as the headlines say to find that every fire had a distinctive color. Due in some cases to dust or moisture in the atmosphere but usually, I think, to the material concerned. Perhaps they were o interest to another world where peculiar people are saying, "They are lucky to have so much carbon in such convenient form."

LEADERSHIP

Electronic Photo
Speedflash Unit.



Model SGI Signal
Generator.

During the past fifteen years
Palec products have won a reputation
unsurpassed in the Electrical and Radio Test
Equipment field.
This leadership is the reward for constant quality,
unfailing accuracy and technical excellence
in every product.

To a long, imposing list of first class instruments have now been added the Palec Photo Electric Exposure Meter and the Palec Electronic Speedflash Unit. The perfection and enthusiastic success of these first Australian photographic instruments, together with the recent entry of Palec into the Oven Indicator field, is hailed as a milestone in Australia's industrial development; proof indeed of Palec leadership.

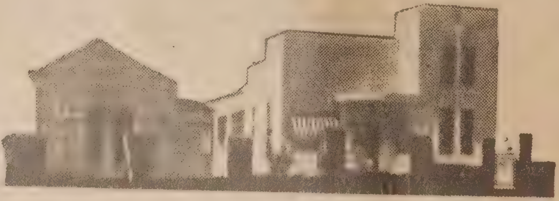
[illegible]

Model M.O.
Modulated Oscillator.

[illegible]

Probe Type Vacuum
Tube Multimeter.

Sector type Pyrometer.

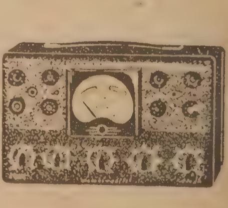


*The Palec Modern Garden Factory and Research Laboratory,
Ashfield, N.S.W.*

Valve & Circuit Tester.

Moving [illegible] Panel
Instruments [illegible]

Moving Coil, Moving Iron, and R.F. Panel Instruments.
Pyrometers.
Bimetallic Thermometers.
Radio Test Equipment.
Electrical Test Equipment.
Photographic Exposure Meters.
Portable and Studio Electronic Flash Units.



Valve Tester.

Moving [illegible] Panel
Instruments (sq. and
rd. types).

Palec
Paton Electrical
PTY. LTD.
Manufacturers of all Types of Radio & Electrical Test Equipment & Meters.
90 VICTORIA STREET, ASHFIELD, SYDNEY
Tels.: UA 5266 (5 lines). Telegrams: "Palec."

P25C FP.

MACHINE PUMPS HEAT FROM GROUND

Heat pumps on the assembly line of the Drayer Hanson works, USA. These machines draw warmth from air, water, or the earth.

A new invention, something like a refrigerator in reverse, is now heating American homes. This article describes how it works. Known as the Airtopa, it opens a new field in domestic and industrial heating.

SEVERAL hundred Americans are finessing fuel shortages and cutting down their winter heating bills with machines which extract heat from the air or earth and move it indoors. In summertime, the same machines push heat in the opposite direction, keeping the houses air-conditioned and cool. These remarkable weather-makers are called heat pumps. They operate by electricity, but otherwise require no fuel.

Free heat? Yes. Nature makes no charge for the heat which is lying dormant in the air and water and earth. You pay only for the electricity to run the machine—electricity which itself gets changed into heat and is delivered indoors, further improving the bargain. The overall result is at least three times as much heat as you pay for, and sometimes much more.

These proportions of free heat are so large that a pound of fuel, when burned in a power station to produce electricity to run a heat pump in a home, can make the house warmer than had the pound of fuel been burned right there in the most efficient home furnace. Here is a fact of far-reaching, nation-wide significance. For it holds forth the prospect of conserving our coal and oil, and possibly our uranium, on a truly gigantic scale.

In a heat-pumping machine, some kind of gas serves as the sponge, not for water but for heat. Any old gas can be made to work, even air, but certain gases like ammonia are more useful as heat sponges and are called refrigerants. A refrigerant, in common with any gas, warms up when it is squeezed and cools off when it expands.

It is this effect which makes heat pumping possible, and the effect is exploited in practical machines by forcing the refrigerant round and round, endlessly, in a circuit of pipe. On one side of the circuit, the cold, expanded refrigerant absorbs heat, much as a submerged sponge absorbs water. As the refrigerant carries its burden of heat toward the other side of the circuit it is squeezed. This makes it hot, enabling it to give off its heat to surroundings which are then relatively cool. Having given up its heat, it is ready to return to the cold side, expanding en route.

The two sides of the circuit are usually formed into coils in order to give the refrigerant plenty of opportunity to absorb and discharge heat. So the working of a heat pump simply consists of carrying heat from a cold coil over to a hot one.

If the cold coil is placed inside a box, the device is a refrigerator. If the cold coil is exposed to an outdoor heat source and the hot coil is placed indoors, the machine is a heat pump for warming a house. Reverse the flow of refrigerant and the cold coil becomes hot and the hot coil cold. By this simple switch of direction, a house-warming heat pump changes to an air-conditioner for cooling.

TAPPING EARTH'S HEAT

This machine gets at the earth heat by circulating water through a hairpin pipe which extends 218 feet into the ground. Water from the pipe is passed over the cold coil of the heat pump, chilled as heat is taken from it, then dispatched on its subterranean round trip to pick up heat again.

Regardless of how heat is obtained outside, it can be delivered indoors to any kind of low-temperature heating system. All present package heat pumps are designed for circulating air through ordinary ducts. In these cases, the heat pump simply replaces the furnace.

Out of the ducts comes a lot of free heat. How much? At this point the heat-pump expert clears his throat and says it all depends. But you can make a close guess. It all depends on where you live. For where you live determines what kind of heat source is at hand, and the source determines how well the heat pump will perform.

An air-source machine will serve where the temperature is seldom below 30 degrees and never below zero. Here you can avoid the buried pipe, but must accept poorer performance on colder days. One manufacturer rates the performance of its three-horsepower machine at 4 to 1 at 45 degrees. This ratio, called the machine's co-efficient of performance, means that you get four times as much heat as you pay for. By the time the weather has got down to 30 degrees, the machine is performing at 3½ to 1.

The Biggest Chassis Value Anywhere at £19/19/-

Very easy terms in Sydney and Metropolitan area.

THE SENSATIONAL

SKY KNIGHT

Full size 5-valve World Range Unit — COMPLETE

Greatest value ever offered in a 5-valve World Range chassis unit. The Sky Knight brilliantly combines many of the distinguished features that have made Sky Raider and Sky Master famous for their sensitivety and phenomenal long range. Assembled ready to instal in your own cabinet. With 12-inch Permag speaker and valves. Standardised components, built-in to a modern tested circuit. Provision for extension speaker, FM plug-in, Pick-up terminals, Gramo switch. Large modern calibrated dial. An incomparable value at £19/19/-.

Fitted with F.M. Plug-in

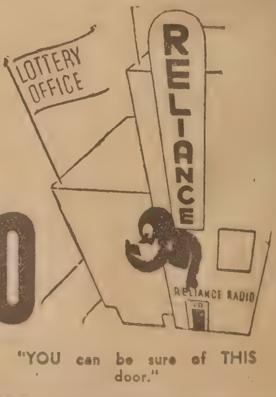
The Sky Knight is equipped with a FM plug-in and the chassis is wired to incorporate a simple converter, should FM reception be required. Just another "forward" feature of your modern Sky Knight.

FREE PACKING AND FREE AIR FREIGHT

Yes, Reliance will carefully pack your Sky Knight chassis Free of charge and Air freight it FREE to the nearest airport in your district. If you cannot call and hear it, write for fuller particulars.

RELIANCE RADIO

10 BARRACK ST., NEXT TO LOTTERY OFFICE
Telephone: BX2691-2-3.



"YOU can be sure of THIS door."

MACHINE WEIGHS, DELIVERS COAL

One of the many jobs of seemingly limitless variety that can be performed by automatic machinery is the weighing of material and the recording of the total quantity delivered at any time. Sketched here is an automatic coal meter or weigher, in operation. The same device can be used for measuring the deliveries of any other freely-feeding substance such as wheat, or grain, or gravel.

AS can be seen from the diagram-sketch, the coal is supplied from a large hopper (at top), which holds great quantities. To reach the machine it passes through a feed valve or gate (shown closed in the sketch).

The coal falls into the weighing hopper, which is really a large scale balanced by a scale-arm and a box of weights. In order to balance the load, the hopper is divided down the middle in two side-by-side compartments.

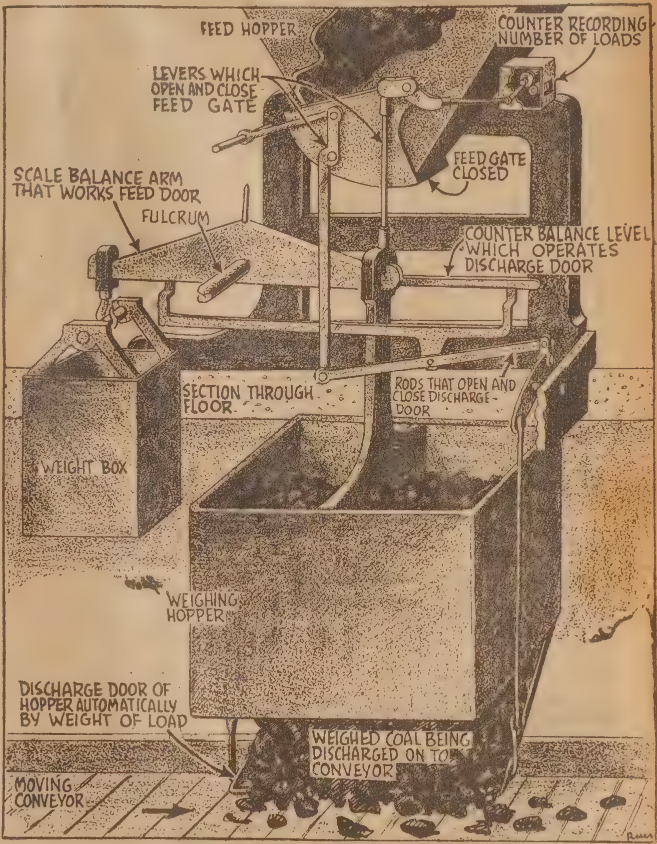
As the weighing hopper fills and reaches the amount determined through the weight-box, it descends. This causes the scale balance arm to swing on its fulcrum, and as it does so it shuts the feed valve by means of a rod and levers. The coal supply to the weighing hopper is then cut off.

As the scale balance arm moves, it also operates a counter-balance arm, which in turn opens the bottom of the weighing hopper, by means of rods. The whole of the load in the weighing hopper is thus discharged on to the conveyor below.

The weighing hopper, having emptied, the weight box on the other end of the scale balance arm brings it back to its original position. The discharge door is closed and at the same time the feed valve from the storage hopper above is opened by the action of the scale arm. The whole cycle then begins again.

Operated by a lever attached to the feed valve, a counter records the number of loads passing through the meter.

As well as saving a great deal of time and valuable effort, the device thus has the advantage of providing an accurate record of the quantity of material passing through the meter.


FEED HOPPER
COUNTER RECORDING NUMBER OF LOADS
LEVERS WHICH OPEN AND CLOSE FEED GATE
FEED GATE CLOSED
SCALE BALANCE ARM THAT WORKS FEED DOOR
FULCRUM
COUNTER BALANCE LEVEL WHICH OPERATES DISCHARGE DOOR
SECTION THROUGH FLOOR
RODS THAT OPEN AND CLOSE DISCHARGE DOOR
WEIGHT BOX
WEIGHING HOPPER
DISCHARGE DOOR OF HOPPER AUTOMATICALLY BY WEIGHT OF LOAD
WEIGHED COAL BEING DISCHARGED ON TO CONVEYOR
MOVING CONVEYOR

SCIENCE SEARCHES FOR OIL

(Continued from Page 13)

various points and the wave produced in the ground by the explosion is reflected back whenever there occur changes in the rock formation. This reflected wave is picked up on the geophone and the time of travel noted. From known speed standards this travel time is easily translated into depth measurements.

By the use of the three methods outlined briefly it is possible to make contour maps of the formations below the surface of the earth and, by subsequent analysis, deduce the possibility of oil being present.

Even the sea bottom is not escaping the attentions of oil prospectors. In shallow portions of the ocean, magnetometers and gravimeters are supported on tripods which rest on the sea floor.

History has recently been made by the drilling of an oil well eight miles off shore in the Gulf of Mexico. The prospectors have found oil bearing salt rock at 8000 feet and are prepared to drill to 15,000 feet for oil.

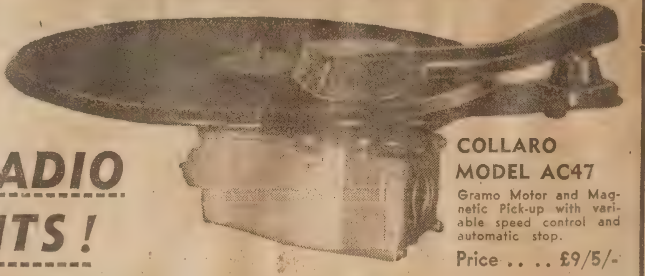
When the venture was ready to get under way, weather men made forecasts of the expected weather, and equipment was made to meet all conditions including winds of hurricane force and 35 feet waves.

Fifty four men work and live on a large platform 206 feet by 110 feet in five-day relays, and it is hoped to make the venture a payable one.

Radar has been commissioned to assist in the search for oil and has been used with some success in the Bahamas, where extensive oil prospecting is going on at the present time. Radar is used mainly by prospecting ships at sea to fix their positions for it would never do to find oil and not know where you were.

So the search goes on night and day the world over.

VEALLS
can Supply
ALL YOUR RADIO REQUIREMENTS!



COLLARO MODEL AC47

Gramo Motor and Magnetic Pick-up with variable speed control and automatic stop.

Price £9/5/-

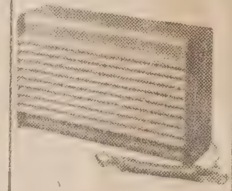
BRAMCO SPEAKER WINDINGS

BI	5000 Ohm	Magnavox Standard	4/8
CI	7000 "	" " - - -	"
DI	10000 "	" " - - -	5/3
MBI	5000 "	" Midget - - -	4/8
MCI	7000 "	" " - - -	"
RB	10000 "	" " - - -	"
RC	5000 "	Rola 8" 10" - - - - - - -	"
RD	7000 "	" " - - - - - - -	"
RE	10000 "	" " " - - - - - - -	"
MRB	5000 "	" 5" 6" - - - - - - -	"
MRC	7000 "	" " " - - - - - - -	"

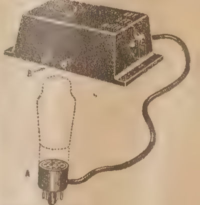
KINGSLEY "PILLO-FONE" EXTENSION SPEAKER

A real miniature 3½ inch diameter by 1¾ inches deep.

£1/15/0



KINGSLEY KR6 EXTENSION SPEAKER £2/18/6



KINGSLEY EXTENSION SPEAKER ADAPTOR £1/2/6

YOUNG ATOM PICKUP
£2/17/6

COLLARO RECORD CHANGER
£23/9/6

TECNICO "Low Pressure" PICKUPS

Model FP8. Crystal Pickup with built-in sapphire stylus £6/9/-

Model FL48. Replaceable needle pickup for general use £5/4/-

EFCO DIALS

MK8A 0-100 Wat B/cast		14	8
USL32 B/cast D/W -	£1	12	4
USL44 D/Wave - -	£1	11	8
FD32 B/cast - - - -	£1	5	0
FD32 D/Wave - - - -	£1	6	0
USL46 D/Wave - - -	£1	19	8
CD31 D/Wave - - - -	£1	15	2
USL379 B/cast D/Wave	£1	7	8

BIRKO Soldering Irons

For radio, general and heavy duty service.

60 Watt	£1	0	0
50 Watt	1	5	0
130 Watt	1	9	8
200 Watt	2	0	2

PORTABLE CABINETS

RH Portable Cabinet	£2	6	9
RH Portable Handle Cabinet ..	1	10	6

BROWN HEADPHONES
£1/13/9

Also obtainable from our Associate Companies
VEALLS (Swanston St.,) Pty. Ltd., 243 Swanston St., Melbourne. FJ3145.
VEALLS, Prahran Pty. Ltd., 299 Chapel St., Prahran. LA1605.

VEALLS
ELECTRICAL & RADIO PTY. LTD.

Head Office: 490 ELIZABETH ST.
MELBOURNE - - - FJ 3145
Telegrams:
"VELRADIO"

Mail Orders to Box 2135T, G.P.O., Melbourne

NEWS AND VIEWS OF THE MONTH

Pickups and speakers

THE last few weeks have brought to light quite a few new items for amplifier enthusiasts. We have noticed in various radio stores quite a number of imported pickups, both magnetic and moving coil, for which useful performance is claimed. Prices have varied from about £4/10/- to £10, according to quality.

So far, we haven't been able to try them all, and cannot say much about their being true to label. However, there is no insuperable difficulty in making good pickups of this type, and the needle armature Connoisseur, which appears to be a fair sample, is one at least which does an excellent job. There is no reason why other types should not be equally as good or better.

A word of warning, however. Many of these pickups—in fact, probably most of them—have a much lower output than the convenient crystal or conventional magnetic types. In such cases, a stage of pre-amplification may be required, possibly with a degree of bass compensation, in order to get the best results.

Do not, therefore, connect such pickups directly into your equipment, and, on finding the tone thin and weak, decide you have wasted your money. Look carefully at the makers' specifications, where you will usually find some guide to these matters. Only when correctly used will you get the best results from your new purchase.

Some of the pickups require input transformers which, carelessly placed, will pick up hum from power transformers, &c. If your pickup has a very low output, requiring a good deal of pre-amplification, filtering and shielding must be given meticulous attention.

These matters have been discussed from time to time in articles we have published dealing with amplifiers.

SPEAKERS

There seems to be quite a bit of activity, too, in the speaker world. Several imported types of speakers have received most favorable comment from our readers. Better news still is that some of our local factories may soon be ready to announce new and improved models which are expected to feature an improved and smoother high note response. They are assured of a ready market when finally we do see them, as interest in recordings has never been greater than it is today.

In fact, the enthusiasm of amplifier fans has been, in our experience, one of the most remarkable things in all our years of home construction.

A low trick

WE were highly amused to read a news par during the week concerning some ingenious scientists who learned how to generate a highly amplified version of the Anopheles female mosquito's buzzing. Apparently it is this buzzing noise which attracts the male mosquito, but until these boys produced their device, no one had succeeded in fooling them by imitation.

So successful was this latest attempt, however, that one large swamp yielded no less than 40,000 male mosquitoes, which, in answering the come-hither call, neatly fried themselves on an electrified screen placed in a strategic position by the aforesaid scientists.

It is the female of this species which is the malaria germ carrier, and which caused so much worry to the troops in the tropics. If only

RADIO CROSSWORD PUZZLE No. 14

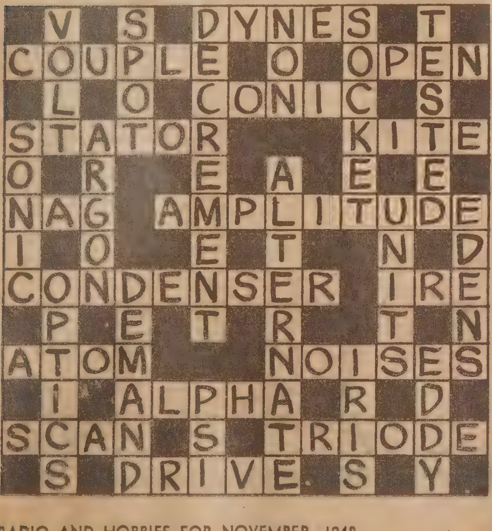
ACROSS

1. This type of tone enters into a complex wave.
8. Three-element valve.
9. Three-wire cable.
10. Meter face (pl.).
11. Movement sideways.
12. Fascination.
16. Mixture of nickel and steel.
20. Insulating material.
21. Aerial for a flat!
22. Five-element valve.
23. Radioactive element.
24. Popular dial.

DOWN

2. Space filled with non-magnetic material. (Two words.)
3. Morse key.
4. Battlefields.
5. Battery. (Two words.)
6. Unit of quantity.
7. Check with meter.
13. Type of ray.
14. Coil.
15. Type of light valve.
17. Unit of current.
18. Positive nucleus of atom.
19. Central part.

BELOW: LAST MONTH'S SOLUTION



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C	O	U	P	L	E	■	O	■	O	P	E	N
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S	T	A	T	O	R	■	■	■	K	I	T	E
O	■	R	■	■	E	■	A	■	E	■	E	■
N	A	G	■	A	M	P	L	I	T	U	D	E
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C	O	N	D	E	N	S	E	R	■	I	R	E
■	P	■	E	■	T	■	R	■	■	T	■	N
A	T	O	M	■	■	■	N	O	I	S	E	S
■	I	■	A	L	P	H	A	■	R	■	D	■
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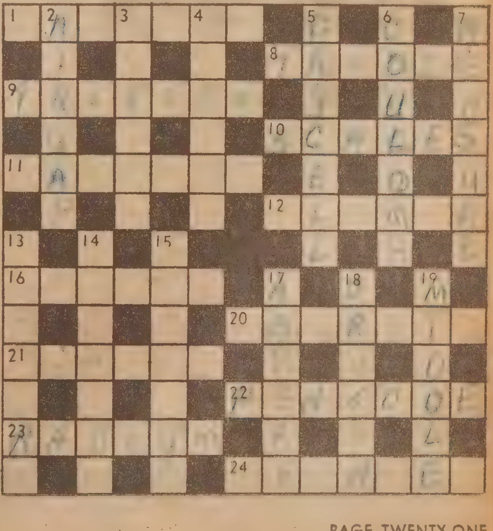
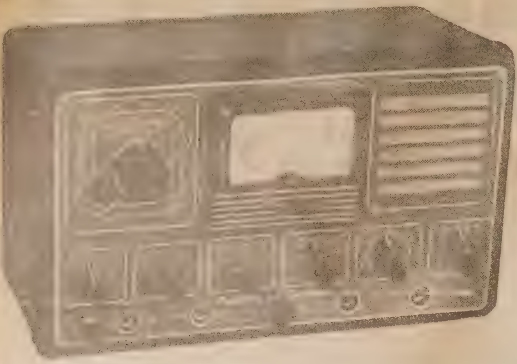




HERE IT IS!

THE NEW SUPERTRACER!!

- *A "SUPER" SIGNAL TRACER*
- *A V.T.V.M. FOR A.C. & D.C.*
- *A SERVICE SHOP IN ITSELF*

[illegible] the most modern, up-to-date and efficient [illegible] instrument that anyone could desire. It is [illegible] to use and gives rapid and accurate location of faults in radio receivers and similar equipment. It speeds up testing, servicing and production and will quickly detect faults which render a receiver inoperative or which make it intermittent or lacking in sensitivity or which cause oscillation, distortion or hum.

It is an attractive, accurately constructed instrument housed in a brocade finished steel case measuring 14[illegible]" long by 8¾" high and 8¼" wide [illegible]. The front panel is heavily etched [illegible] with raised nickel plated lines and letters on a wine coloured enamelled background. This striking but dignified colour scheme adds prestige to your organisation and sets the seal of reliability upon your shop equipment.

The instrument comprises a two stage tuned R.F. amplifier, a diode detector and two stage A.F. amplifier, and, of course, a loudspeaker and power supply. In addition, a vacuum tube voltmeter measuring up to 500 volts A.C. or D.C. at a resistance of 11 megohms on D.C. and 10 megohms on A.C. is provided. The tuning range of the R.F. circuits is 175 to 490 K.C., 550 to 1550 K.C., 1.5 to 4 megacycles and 6.3 to 18 megacycles. R.F. sensitivity is such that input voltage of the order of a few millivolts may be detected on all ranges so that the instrument is suitable for use in any district where alternating power mains are available. A capacity type R.F. multiplier in the input circuits in conjunction with the V.T.V.M. enables stage gain measurements to be made.

TEST PROBES: The R.F. test probe is fitted internally with a very small series capacity of a few micro-microfarads so that it does not produce an appreciative detuning effect when applied to the grid or plate of R.F. or I.F. stages in a receiver. The A.F. test probe is a conventional shielded lead for feeding A.F. into the tracer or A.F. out from the tracer for testing A.F. amplifiers or speakers. The D.C. probe contains a series 1 meg. isolating resistor so that the V.T.V.M. may be used to measure plate, bias or A.V.C. voltage under actual operating conditions, without disturbing the action of a receiver.

VACUUM TUBE VOLTMETER: The V.T.V.M. features a centre zero scale for direct voltage measurement so that voltages which are either positive or negative with respect to a receiver's chassis are instantly indicated without the necessity of reversing test leads or operating a reversing switch. Zero is at the left for alternating voltage ranges and operation covers the audio frequency range. Voltage ranges are 0/5, 0/25, 0/100 and 0/500 volts at an input resistance of 11 megohms on D.C. and 10 megohms on A.C. ranges. In conjunction with the amplifying stages of the tracer, the meter will indicate R.F. or A.F. voltages down to a value of less than 1 millivolt. Indications are provided by a large, clearly marked rectangular meter with illuminated scale fitted in an attractive modern plastic case measuring 4¾" x 4". The V.T.V.M. and tracer may be used simultaneously for observing signals at two distinct points in a receiver. This feature greatly facilitates location of intermittent faults.

POWER SUPPLY: Operation is from A.C. power mains at a voltage of between 220 and 260 volts and at a frequency between 40 to 60 C.P.S.

ANOTHER **University** INSTRUMENT

Made by Radio Equipment Pty. Limited, 5 North York Street, Sydney.

the mosquitoes themselves don't get wise, it might be an excellent way to exercise malaria control.

What next will these backroom boys bring forth?

Mobile radio

OUR activities with mobile radio seem to have created some interest overseas. Quite a few overseas journals dealing with newspaper activity carried a story referring to the fact that the Sydney Sun was the first newspaper in Australia to report news by radio.

Our latest bow was taken in the most widely-read Swiss weekly paper, Die Wochen Zeitung, which carried a five-inch par all about it.

Plastic coatings

A NEW technique which seems to be giving results overseas, and one which seems very logical, is the plastic coating of objects in order to give them the moisture and heat-resisting properties of the plastic itself.

Many materials which are structurally suitable for building houses, for instance, cannot be widely used because they are too porous. Others will not stand weathering. There are, however, plenty of plastics which will wear well under all climatic conditions.

The procedure is to spray the bricks, or whatever substance is concerned, with a plastic solution which dries out into a transparent film. The solution may also be painted rather than sprayed.

When one thinks of it, plastics have come so much into our daily lives as to be almost indispensable. They are supporting a vast and important industry which has scarcely more than made a beginning.

Embossed grooves

SEVERAL months back we ran a short story about equipment which embossed grooves on a disc, 300 to the inch, and played them back with good fidelity. At the time, it was envisaged that the chief benefits of the scheme would be either to compress the usual quarter hour programme from a 16in transcription disc to something very much smaller or to allow lengthy features to be recorded on a single large disc.

As it turns out, the process or a modification of it, has been switched into the domestic gramophone market. With a due amount of ballyhoo, a special Press conference was arranged to introduce the new long-playing disc to Mr. and Mrs. America.

The public was told how it would now be able to buy 12in discs with no less than 45 minutes of music on each side. Accordingly, the latest catalogues carry details of record players, pickups and turntables to suit.

If these new vinylite discs prove to be serviceable, they will provide the answer to the challenge of wire and film recorders, and become a further pillar of support to the gramophone industry. The appeal will be chiefly to the classical market.

HOW THE "WALES" WORKS — Branch Series No. 6

The Junior

Mr. Donald Smith, a recent recruit to the 5,600-strong staff of the Bank, who joined in Brisbane. Now Junior at Winton (Qld.) Branch.

ENTERING the Bank at from 15 to 19 years of age, new recruits to the "Wales" must be of Intermediate Certificate, or higher, educational standard. They are usually posted first to branches near their homes as "Juniors."

The Junior looks after "postages", records and mails all correspondence, helps with the daily "balance" which checks all funds received into and paid out of the branch, and assists generally in the office work.

Right on the threshold of his career, he is already acquiring the experience and familiarity with banking terms and practices which will fit him for promotion to the specialized posts which are open to those of initiative and ability.

Candidates for admission to the service of the Bank should apply to the Manager of their local branch.

Consult and use—

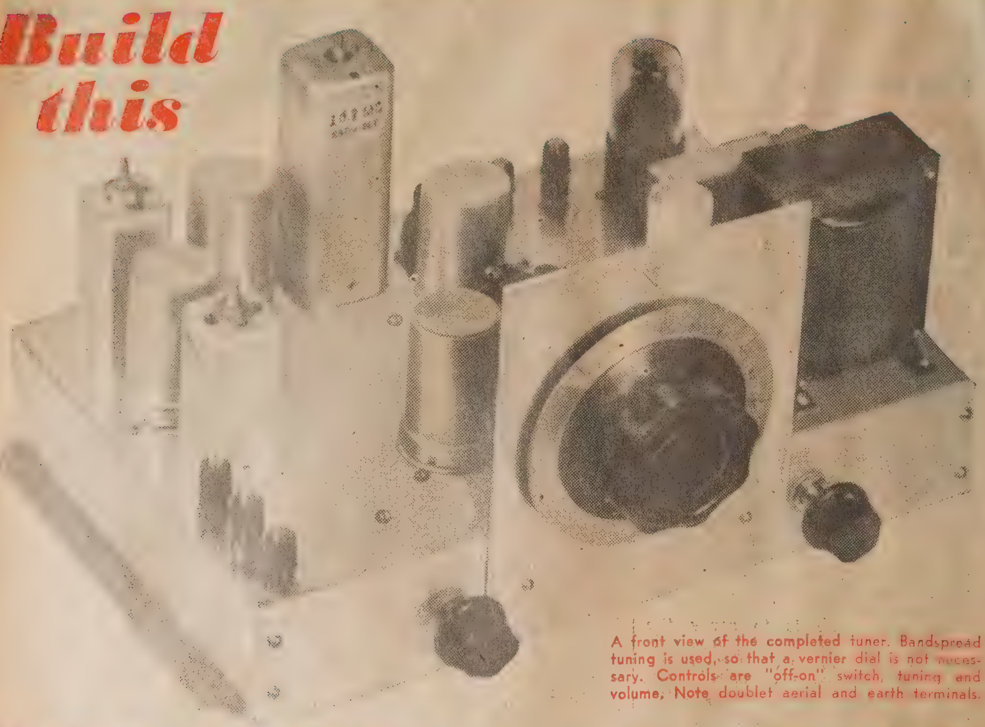
BANK OF
NEW SOUTH WALES

FIRST BANK IN AUSTRALIA

Incorporated in New South Wales with limited liability

A4813H

Build this



A front view of the completed tuner. Bandspread tuning is used, so that a vernier dial is not necessary. Controls are "off-on" switch, tuning and volume. Note doublet aerial and earth terminals.

EXPERIMENTAL F.M. TUNER

Here is an F.M. tuner which can be built up from familiar short-wave components, and using valves which are obtainable readily and cheaply from disposals stocks. It will allow you to tune in the experimental A.B.C. broadcasts and gain practical experience with this new and specialised equipment.

by W. N. Williams

THERE is no need at this juncture to emphasise the interest which just now centres around frequency modulation. We had all known, of course, that experimental transmissions were in progress and that a regular service was a distinct possibility. However, a recent announcement by the Prime Minister brought to light many hopes and fears about FM and, incidentally, stirred up a first class row about commercial rights to this part of the spectrum.

However, leaving politics aside, the plain fact is that many readers have become keen to build a tuner and to learn something of the practical side of FM. Stations are in operation in Sydney and Melbourne, from 10.30 am to 10.30 pm, carrying a selection of ABC programmes. Similar stations are projected for the other capital cities.

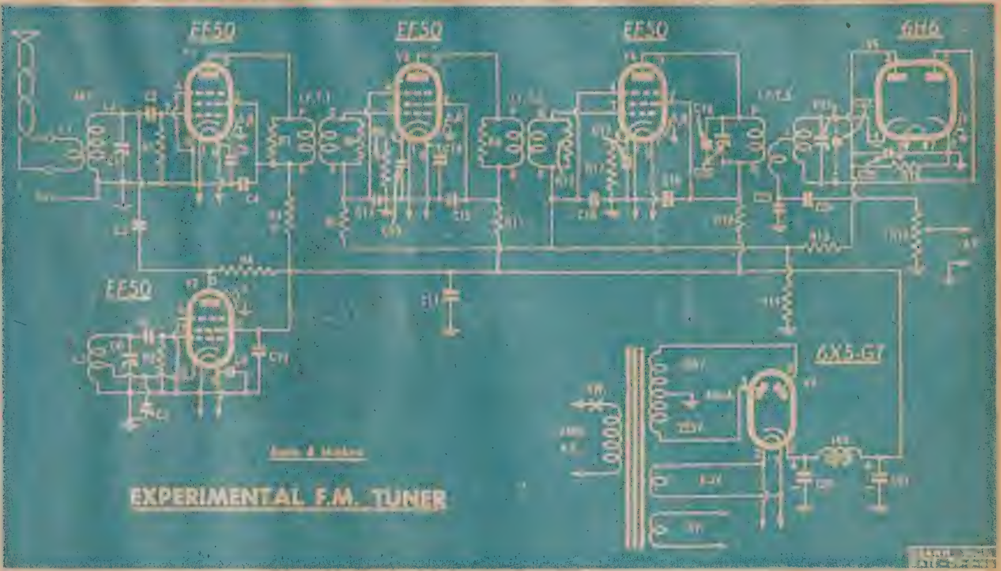
Our own experience with VHF transmission indicates that most listeners in the respective metropolitan areas can expect a service from the single transmitter, within a radius of say 20 miles. There will inevitably be areas, notably shielded beaches and low-lying flats, where the signal strength will be poor but only practical experience will show the full extent of the variation between good and bad areas.

By the same token, there will be spots outside the suggested 20-mile radius where good signals will be obtained, notably on high ridges with a fairly clear line of sight to the transmitting aerial. Under these conditions, reception over 50 or 60 miles is well within the bounds of possibility.

When considering the construction of FM equipment, whether it be a complete receiver or a tuner only, there are two distinct methods of approach. One is to evolve a design using valves and components especially intended for the job. The "Radiotron" circuit, recently released, is an excellent example of this approach. The difficulty, as far as the home builder is concerned, is that the said components and valves are both scarce and costly.

The alternative method—and the

CIRCUIT USES FAMILIAR U.H.F. COMPONENTS



The only special components in this circuit are the two 10.7 Mc. IF. transfomers and the discriminator transformer. A ratio detector is used, and the output should be fed into an audio amplifier having fairly high gain — as for a magnetic pickup.

one we have adopted—is to recognise that the FM service is still experimental and that there is but one station in each capital to listen to. Furthermore, that radio stores have recently handled thousands of valves and oddments which, coming from radar equipment, are well suited for use at 90 megacycles.

Our first FM tuner, therefore, is built with components and along general lines which are familiar to all who have dabbled with shortwave receivers, particularly of the VHF variety.

It was built on an aluminium chassis, measuring 12in x 8in x 2in, made deliberately large enough to allow for future expansion and experiment.

We used an instrument type dial, but there is room and a cut-out to accommodate a conventional dial movement, if you should prefer it.

Our single-section tuning condenser is mounted well back on a metal bracket but you will find that there is room to instal a miniature low-capacitance 3-gang at some time in the indefinite future. Alongside this you could place a bracket carrying a miniature RF amplifier and a mixer valve, and so on, ad lib.!

At this early stage, chassis manufacturers cannot be expected to turn out a whole line of units to meet a limited demand and our whole idea has been to evolve a layout which is amenable to modification as you may see fit. It is safe to assume that the IF channel and power supply will remain unaltered, the changes, if any, being made in the RF end and the detector.

THE CIRCUIT

Now for a look at the circuitry:

The initial design provides for a high gain pentode mixer and a separate pentode oscillator, using grid injection. We have found this system particularly effective in amateur equipment and it represents far and away the best compromise between

PARTS LIST AND KEY TO CIRCUIT

1 Chassis 12" x 8" x 2".
2 Power transformer 225V/0/225V. 40mA. 5V. 2 amps 6.3V. 3 amps.
1 14 Henry 60mA. filter choke.
1 Dial to suit.
2 10.7 Mc. I.F. transformers with built-in loading resistors.
1 10.7 Mc Ratio-Detector transformer.
2 Octal valve sockets.
4 9 pin valve sockets EF50.
5 Terminals (3 red, 2 black).
Small quanitiy 16 SWG. tinned copper or silver-plated copper wire for tuning coils.

SUNDRIES.—
Bakelite mounting strip, tinned copper and insulated hookup wire, nuts & bolts, solder lugs, power cord etc.
VALVES:—4-EF50 (VR91), 1-6X5-GT (or 5Y3-GT), 1-6H6-GT.

CONDENSERS.—
C1 30 pf. miniature air trimmer.
C2 100 pf. mica.
C3 4 pf. approx. (twisted hookup or miniature air trimmer).
C4, C5 .01 mfd. mica.
C6 30 pf. miniature air trimmer.
C7 two plate variable (tuning).
C8 50 pf. mica.
C9 .01 mfd. mica.
C10 .001 mfd. mica.
C11 0.25 mfd. tubular.
C12, C13, C14, C15 .01 mfd. mica.
C16, C17, C18 .01 mfd. mica.
C19, C22 10 pf. mica (may or may not be necessary).
C20, C21 30 pf. miniature air trimmer.
C23 .01 mfd. mica.
C24 0.1 mfd. tubular.
C25 8 mfd. electrolytic.
C26, C27 16 mfd. 525 PV. electrolytic.

RESISTORS.—
R1 0.1 meg.
R2 .04 meg.
R3, R4 1000 ohms.
R5 5000 ohms.
R6 200 ohms.
R7, R8 .03 meg. (or other selected value normally included in I.F. transformer).
R9, R10 .04 meg. (or other selected value normally included in I.F. transformer).
R11 1000 ohms.
R12 1000 ohms.
R13 0.25 meg.
R14, R15 .05 meg.
R16 0.5 meg. potentiometer.
R17 200 ohms.

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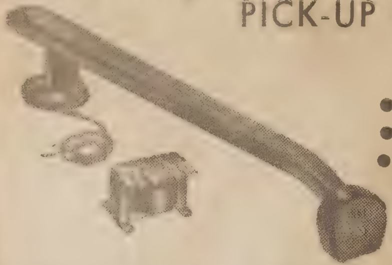

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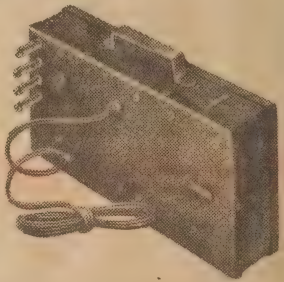

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factors of gain, noise level and economy.

No RF stage is provided, the chief objection to this omission being possibly in the fact that a small amount of energy at oscillator frequency is present in the aerial circuit. While the possibiilty of radiation is a legitimate technical objection, we do not feel that it is a very important one at this early stage.

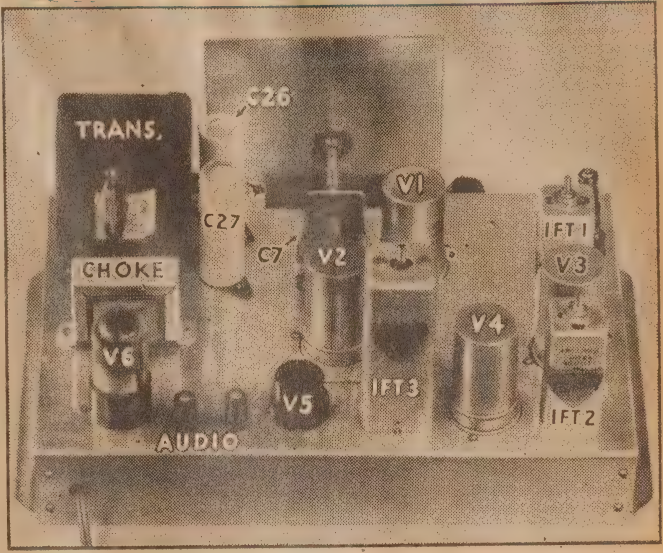
The dipole aerial leads are fed into two terminals which connect beneath the chassis to a single turn primary (16 g. copper) mounted close to the "earthy" end of the grid winding.

The grid winding consists of two turns of about 12 gauge wire, wound to an inside diameter of ½-inch and opened out to leave a spacing of about 1-8in. between the turns. Silver plated wire is the best choice but tinned or bare copper will do.

For rigidity, the coils are best mounted on a tag strip, taking care to keep the bakelite clean and free from flux. The coils should be as close as possible to the valve socket, to avoid lengthy leads.

One must realise that, with only a two turn coil, not much extra lead is necessary to show an appreciable relative inductance. Both ends of the coil are important—its connection to grid on the one hand, and to cathode and earth on the other.

REAR VIEW OF THE CHASSIS



This coded photograph shows the position of major components on the chassis. Short leads in the aerial and oscillation tuned circuits are absolutely essential if the receiver is to operate on 90mc.

HEATER EARTHING

When wiring the individual stages, select an earth point which is handy alike to the cathode and to the "earthy" end of the coil. Return the coil, the cathode bypass, screen bypass and valve shielding all separately to this common point, avoiding lengths of wire common to any of the components mentioned.

The heater circuit is also vitally important in an FM receiver, since a lot of trouble can be experienced with modulation hum. It is wise to earth one side of each heater separately and directly to the common earth point for each stage. Naturally, it must be the same side of the winding in each case to avoid a short circuit. The other side of the heater, for all valves in the tuning, oscillator and IF circuits should preferably be bypassed back to the same common point or straight across the pins.

Under no circumstances must the heater or its bypass connect to the valve shell or to a return lead of the coil, even though this is ostensibly earthed. When the coils are so small, such a connection would be equivalent, in a broadcast receiver, to tapping in several turns up from the bottom of the coil.

The oscillator is a conventional cathode-tapped arrangement, which has the advantage of simplicity and allows the spindle of the tuning condenser to be earthed. You had better follow our layout exactly if you want to find the station at all.

The oscillator coil is wound to the same specifications as the aerial grid coil and is mounted directly across the bottom of the oscillator socket. It is tuned by a miniature 30pf trimmer, which must be of the air-dielectric type. Use of a mica trimmer would invite trouble with frequency drift.

The cathode is tapped in at slightly less than half a turn from the earthy end of the coil and the 2-plate tuning condenser above the chassis taps in at the same point. It thus operates as a band-spread condenser and allows the station to be tuned over a large sweep of the dial. With only one station in operation, this is a perfectly simple and legitimate method.

TUNING CONDENSER

It is wise, by the way, to fit a rear wiper contact to the tuning condenser to provide a more direct earth return than is possible through the spindle or front wiper. A two-inch earth return at 90mc is equivalent to about 16 feet of lead in the middle of the broadcast band.

WHEN you have completed this FM tuner, write and let us know about the results obtained from it:—Where you are situated, the signal strength in your district, effect of aerial position, ignition noise, fidelity and any problems which may have arisen with construction and alignment.

The circuit around the oscillator and mixer valves is otherwise conventional, although special mention of the injector circuit, is warranted. This involves a very small capacitance between the plate circuit of the oscillator and the grid circuit of the mixer and, for the purpose, we used another miniature air-trimmer set near to its minimum position. The coupling capacitance is therefore about 4pf. This could be provided alternatively by two pieces of plastic-covered hook-up twisted together for a few turns.

Too little coupling capacitance has a serious effect on gain, while too much coupling will cause instability.

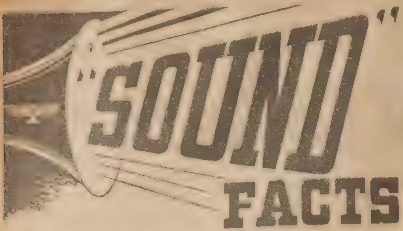
The IF channel employs 10.7mc IF transformers and two more EF50 type valves. These operate with equal voltages on plate and screen, so that a common bypass and decoupling resistor serves for both circuits. It is important that this bypass return the common earth point for the stage.

Actually the decoupling resistors may not be essential, while it may even be possible to omit the cathode bias components and increase the AVC resistors to provide grid leak bias instead. However, for the very few extra components involved, we prefer at this stage to be conventional.

ACCEPTANCE BAND

The 10.7mc IF transformers should be purchased as a kit intended to operate in an FM receiver. Apart from anything else, they will have loading resistors connected internally across the windings to give a specific bandwidth and "Q" factor. These resistors will normally be installed by the manufacturers and are merely shown dotted in the schematic circuit.

Higher overall gain can be achieved, of course, by removing the resistors or increasing their value, but the IF pass band may then be insufficiently wide to cope with normal carrier deviations. As it is,



No.2 To measure the output resistance of an amplifier, connect a tone source to the input of the amplifier and adjust the output of the amplifier so that 10 Volts A.C. is measured across the open circuit secondary terminals of the output transformer. Connect a variable resistance across the secondary terminals without altering the amplifier output and adjust this resistance until 5 Volts is measured across the resistance. Disconnect the resistor and measure the value that was connected across the secondary terminals. The measured value of the resistor will be equal to the output resistance of the amplifier.

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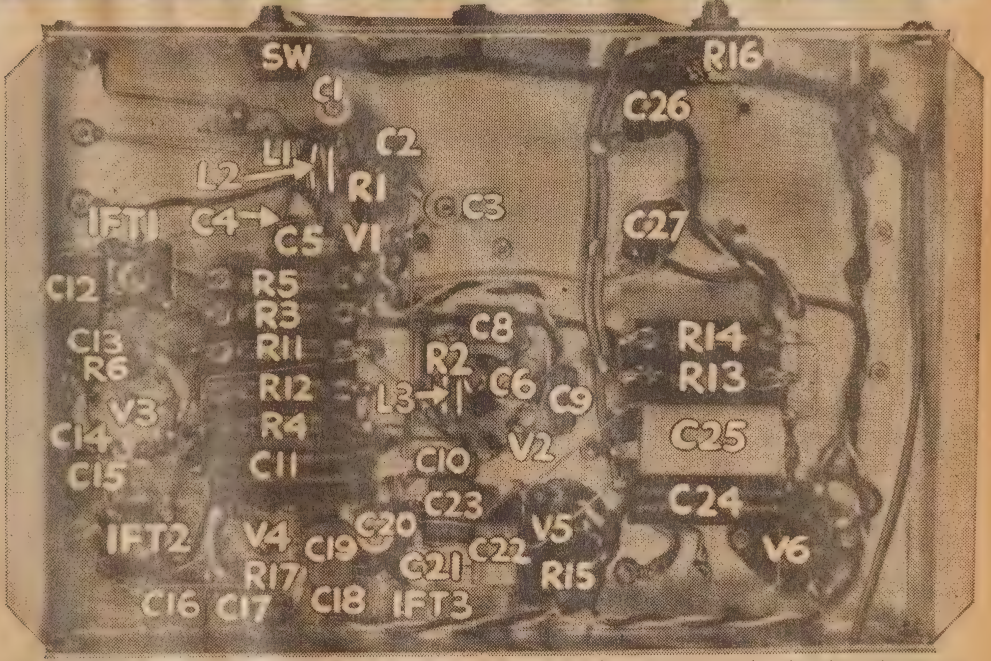
PHOTOGRAPH SHOWS POSITION OF COMPONENTS



All grid and plate wires run direct from point to point. Mica R.F. bypass condensers group around each socket and return to a common earth point for the stage. Less important components, such as decoupling resistors mount, for firmness, on cillator sockets.

the high Gm. valves will give sufficient gain for most purposes.

The AVC voltage comes from the detector circuit and is applied only in part to the two IF amplifier valves. The AVC characteristic is less important than in an AM receiver and too high a voltage limits the input to —and the audio voltage from—the ratio detector.

Other high gain valves like the 6AC7 could be used in place of the EF50's specified, but suitable arrangements would have to be made for the screen supply. The overall performance would be much the same.

The third transformer is the discriminator transformer, which feeds the ratio detector. The function of this transformer and the operation of the ratio detector was explained in a special article last month and calls for no repetition here.

It will be noted that the transformer has a condenser across both primary and secondary windings as well as a slug in the secondary.

MUTUAL EFFECTS

Current design practice is to wind slightly more turns on one half of the secondary than the other, so that there is a slight initial unbalance in the inductance values. However, an iron slug is fitted to the lesser half so that its inductance can be increased sufficiently to achieve an exact balance between the two halves.

The condensers, which need to be added externally, resonate the windings to 10.7mc. Obviously, varying the slug position to achieve balance will alter the total inductance of the secondary and necessitate resetting the condenser. A slight mutual effect is also likely to be present in the primary, so that the adjustments are partially inter-dependant. More will be said of this anon.

We expected that a 30 pf air trimmer across each winding would give a sufficient range of adjustment, but, with the particular transformers used in the original tuner, it was necessary to make the maximum capacitance up to 40 pf by wiring a 10 pf fixed mica condenser across the air trimmer.

A point of interest is that a .01 mfd mica condenser is shunted directly across the 0.5 meg volume control. This introduces just sufficient treble attenuation to offset the deliberate treble boost at the transmitter.

The audio output from the ratio detector is considerably lower than from a conventional diode AM detector so that an audio amplifier with reasonable overall gain is required. However, any amplifier capable of being loaded up with an ordinary magnetic pickup should fill the bill.

With the 807 triode amplifier, the overall gain in some areas may be on the low side, making it desirable to reduce the feedback factor slightly, or to provide a low gain preamplifier.

The tuner can be coupled to the amplifier through any convenient length of shielded cable. With a 0.01 mfd condenser already shunted across the audio channel, the additional capacitance of a few feet of shielded wire will not make any noticeable difference.

The power supply arrangements for the tuner are quite conventional. A 225 volt, 40 milliamp power transformer, 6X5-GT rectifier and a simple filter provide just under 250 volts for the plates and screens.

The various photographs give a good idea of the placement of components not specifically mentioned in the text.

To put the tuner into service, you will first of all need a resonant aerial, notably a dipole with suitable feed line. It is not wise to depend on any other type of aerial, no matter how impressive it may be at lower frequencies.

FEED LINE

To make a dipole aerial for this frequency, obtain a light wooden dowel and two 2ft 6in lengths of heavy-gauge copper wire or metal tubing. Mount the pieces of wire or tubing end-to-end on the dowel by means of small stand-off insulators. The inner ends should be about ½in apart, although the exact spacing is not critical.

The impedance at the centre of a simple dipole is about 70 ohms, so that a correct match will be obtained by using a length of 70 ohm coaxial line or a 70 ohm balanced line —

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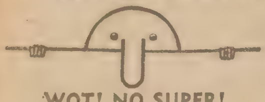
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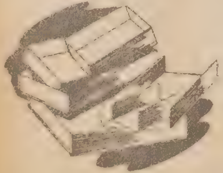

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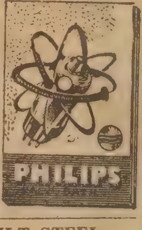

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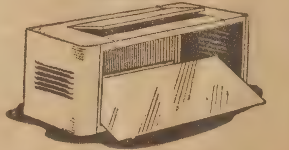

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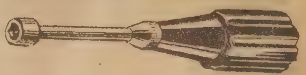

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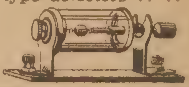

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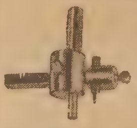

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preferably the latter—one conductor being connector to each element at the inner end. Suitable 70 ohm twin cable is available cheaply from many radio stores but, if you have it on hand, you can make do with twin plastic light flex, which has a characteristic impedance of about 125-150 ohms.

The transmission line can be of any convenient length but should run from aerial to tuner as directly as possible, avoiding too many abrupt turns. This is all standard UHF practice and is not peculiar to FM.

Erect the aerial as high as possible. In a tile-roofed house, it can often mount very conveniently under the gable.

Connect the aerial to the tuner, couple to an amplifier and make the usual checks for voltage on plates, screens and cathodes. Break the earth connection of the oscillator grid resistor and check the grid current, which should be set at about 0.15 mA, by varying the position of the cathode tap.

For initial checking, keep the oscillator injection to a minimum by screwing the condenser right open.

ALIGNMENT

Your approach to the problem of alignment will depend entirely on the equipment which is available for the purpose.

Unless you have access to equipment designed for the job, the alignment of an FM tuner is necessarily a "messy" business. The job can be done accurately with an AM standard signal generator, the procedure being set out at length in "Radiotronics" 127. However, this information is of limited value, since few constructors will have access even to an AM generator of adequate design.

The home constructor therefore has to fall back on much less precise methods and align the tuner by a combination of method with "cut-and-try."

If you have a short-wave service oscillator, feed the signal into the mixer grid at 10.7 Mc. and proceed to align the IF transformers. The simplest method is to wire a 10 mA meter in the cathode circuit of one of the AVC controlled valves and set the input until the AVC voltage causes the cathode current to dip appreciably. Then proceed to align the primary and secondary of all transformers for maximum dip, except the secondary of the discriminator transformer.

Then, keeping the signal exactly in tune, vary the setting of the secondary trimmer until the audible output dips to a minimum value. You will need a wooden or bakelite tool to make this adjustment, as both sides of the trimmer are "hot."

FINDING THE STATION

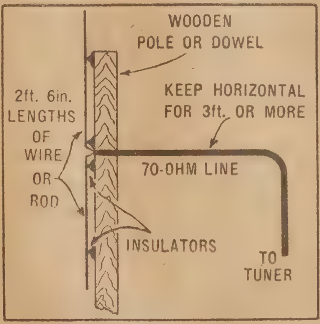
After this initial alignment of the IF channel, it is necessary to find the correct signal frequency, normally by tuning in the station.

Set the aerial circuit trimmer to about half open position, likewise the two-plate tuning condenser. Turn the gain to maximum and carefully rotate the oscillator trimmer until the station is heard. After that, the aerial circuit can be peaked and the general performance tested with slightly increased oscillator injection.

If no signal generator is available, prior adjustment of the IF transformers is, of course, impossible.

It is therefore necessary to assume that they are near enough to the mark and to proceed straight away to find the FM station. Once having found the station, connect a meter in an IF cathode circuit to show AVC action and proceed to peak all circuits except the discriminator secondary for maximum signal input and therefore maximum AVC action. Do not worry about the sound issuing from the speaker while doing this.

Then, keeping the receiver exactly in tune, vary the setting of the secondary trimmer until the signal is clean and free from distortion.


WOODEN POLE OR DOWEL
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2ft. 6in. LENGTHS OF WIRE OR ROD
70-OHM LINE
INSULATORS
TO TUNER

Sydney listeners will need an aerial like this. In Melbourne the elements should be mounted horizontally, side on to the station. Ultimately all stations will employ horizontal polarisation.

With only an oscillator available, and no meters, the rule of thumb is first to render the ratio detector inoperative by deliberately screwing the trimmer hard in or hard out. Then adjust the IF transformers, right up to the discriminator primary, for maximum sound in the speaker. Finally adjust the discriminator secondary for minimum audio output.

DISCRIMINATOR

By one or other of these methods, you should be able to obtain a signal of reasonable quality. The final point is to assess the balance of the discriminator transformer.

The procedure was also explained at length in "Radiotronics" 127 but, once again, much more primitive methods must be adopted by the average home constructor.

You will find that an FM station gives three distinct responses in a receiver, the main centre response and a smaller one at either side. In between there will be a region of minimum signal, the side responses themselves being distorted. The balance and position of the two side responses is itself an indication of discriminator balance.

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(Plus postage for mail orders. Also add country and interstate exchange.)

Illustration enlarged approx. 5 times.

Ideal for Automatic Record Changers

"Coronet" Features:

- *Minimum life of 2000 playings.*
- *Gives high fidelity reproduction to 5000 cycles.*
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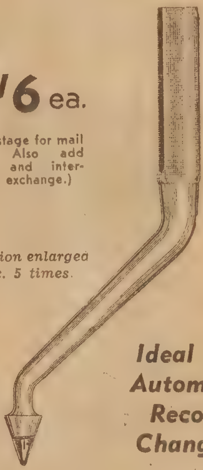
Available from leading radio and music stores.

A·R·C

Australian Record Co. Pty. Ltd.

29 Bligh Street, Sydney. BW6953, B5139.
4.8.



VIBRATOR SUPPLIES

FS6 power supplies. 6 volt D.C. input. Filtered H.T. output 290v. and 175v. at 100 M.A. 20 volt bias supply. A.W.A. gas-filled vibrator. Complete in shielded case. Weight packed, 30lb.
PRICE, F.O.R. **£4/15/-**

NEW VOLTAGE REGULATED VIBRATOR POWER SUPPLIES

Input—24v. D.C.
Output—135v. at 50 m/As.
Features: Valve voltage regulator, non-synch. vibrator, Selenium bridge rectifier and complete filter. Measures overall—9½ x 6½ x 3ins. Weight 10lbs. Supplied with circuit diagram.

PRICE £4/10/- EACH

Post N.S.W., 3/-; Interstate, 7/-.

VIBRATORS

Suitable for R. & H. 75-watt supply. Oak 6-volt 7-pin split reed synchronous. Type V5211: 65UH.
Price **12/6**

Post N.S.W., 9d; Interstate, 1/6.

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240 volt, 3 amp.
Suppress electrical interference from drills, vacuum cleaners, sewing machines, motors, etc. Price 12/6
Post N.S.W., 1/6; Interstate, 3/-.

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2-inch Standoffs, Each	2/6
1-inch Standoffs. Each	1/-
½-inch lead throughs. Each	1/-

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Imported 2" square flush mounting, 500 M.A. R.F. thermocouple meter, mounted in bakelite case. 2¾" x 4" x 2", also contains 2 position switch and pea lamp holder.
PRICE **17/6**

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SPECIALS

BC375 100 watt Transmitters, complete with 5 coil units	£25
BC375 Coil Units	£3/10/-
TA12D 100 watt Transmitter, less mod.	£18/10/-
Gibson Girl Emergency Transmitters. Price	£4/10/-
108 Mk. II Transceivers, less valves. New	£6/5/-
Used	£3/10/-
RA10DA Bendix Aircraft Receivers. 150 kcs. to 10 mcs. Less tubes	£11/10/-
Command Receivers, 3-6 mcs. 6 valve. Complete. New.	£6/10/-
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No. 11 Genemotors, 12 volt-450 volt at 40 M.A.	30/-
SCR522 Transceiver Genemotors. Price	£4/10/-
Ducon Ceramic Octal Sockets, Ea.	1/-
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6 volt Solenoid Relay, 5 amp contact. Each	6/-
24 volt Solenoid Relay, 5 amp contact. Each	6/-
Knife Switch, 100 amp. Each	12/6
Phone Jacks and Plugs. Pr. 2/-; ea.,	1/-
Coax Connectors, Pye type. Pair 3/-; each	1/6
Vibrator A. R.F. Chokes. Each	2/-
685 microhenry 500 M.A. slot wound R.F. Chokes. Each	1/-
High to low Impedance Headphone Adapters. Each	4/6
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Variable tone Buzzer Transformers. Each	3/-
Mike to Grid Transformers, carbon and Dynamic. Each	6/-
Headphones, low impedance. Each	7/6
Headphones, high impedance. Each	17/6
Double button Carbon Mikes. Each	7/6
Carbon Throat Microphones. Each	7/6
Carbon Mike Inserts, carbon diaphram. Each	2/6
Dynamic No. 7 Mike Inserts. Each	6/-
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Ceramic Formers. 6" x 1½" dia. Ea.	3/6
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Green and red Bezels. Each	1/6
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I.F. TRANSFORMERS

A.W.A. 455 Kcs. Variable Iron Core. Each	5/6
U.S.A. 6.9 mcs. 1st, 2nd, 3rd, Var. Iron Core. Each	7/6

Post N.S.W. 6d each.

DRY PLATE RECTIFIERS

Westinghouse Copper Oxide, 6-12 volt at 1-2 amps. Each	15/-
Full wave bridge Copper Oxide, 100 M.A. Each	3/6
Half wave Selenium, 5 M.A. Each	2/6

A.W.A. 11-VALVE U.H.F. RECEIVER

Frequency range, 190-210 mcs.
2-R.F. stages, 5-I.F. stages, cathode follower output.
30 mcs. I.F. channel.
Slug tuned coils.
Built-in checker meter.
Valves required: 2-954, 2-955, 6-6AC7, 1-6H6.
Easily convertible to 144 or 288 mcs. Amateur Bands.
Price, less Valves (F.O.R.) **£4/10/-**

Weight 15lbs. Packed 20lbs.

No. 11 TRANSCEIVERS

Complete with valves, less genemotors. Price F.O.R.	£6
Less valves and genemotors. Price, F.O.R.	£3

POTENTIOMETERS

1000 ohm. wire wound	2/-
500 ohm midget	1/6
250 ohm 25 watt I.R.C.	4/6
50 ohm wire wound	2/-
25 ohm Heavy Duty, 1 amp.	5/6
12 ohm Heavy Duty, 2 amp.	5/6
6 ohm wire wound	2/-

240-volt 50 c.p.s. TRANSFORMERS

318v. C.T. 318v. 150 M.A., 5v. 2 amp., 6.3v. 5 amp.	25/-
350v. C.T. 350v., 150 M.A., 5v. 2 amp.	25/-
375v. C.T. 375v., 500 M.A. 5v. 4 amp.	50/-
1130v. 30 M.A. 2.5v. 3.5 amp. 6.3v. 2.5 amp.	37/6
2800v. 30 M.A. 2.5v. 2 amp.	37/6
5000v., 30 M.A.	50/-
2 x 2.5v. 2 amp., 5000 volt insulation	25/-
5v. 5 amp.	15/-
6.3v. 4 amp.	15/-
6 x 6.3v. total current 11 amps	25/-
2 x 8.5 8 amps.	25/-

FILTER CHOKES

10 amp	30/-
285 M.A.	30/-
150 M.A.	20/-
100 M.A.	7/6
50 M.A.	5/6
15 M.A., 50H. C.R.O. Choke	15/-

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80mfd	250vw	20/-	1mfd	3500vw	15/-
10mfd	400vw	8/6	1mfd	2000vw	10/-
8mfd	1000vw	25/-	1mfd	1000vw	5/-
2 x 8mfd	600vw	12/6	.5mfd	3000vw	7/6
4mfd	1000vw	15/-	.25mfd	3000vw	7/6
2mfd	2000vw	22/6	.25mfd	1000vw	2/6
2mfd	1800vw	20/-	.1mfd	3500vw	5/-
2mfd	1000vw	12/6	.1mfd	2000vw	3/-

ELECTROLYTIC TYPES

2000 mfd. 12 P.V.	4/6
1000 mfd. 12 P.V.	2/-
500 mfd. 100 P.V.	7/6
200 mfd. 100 P.V.	4/-

VALVE SPECIALS

1K7G	8/6	832	90/-
1M5G	8/6	879/2X2	12/6
3A5	15/-	955	12/6
6AC7	15/-	956	15/-
6H6	7/6	9001	15/-
6H6GT	7/6	9003	15/-
6J7G	12/6	12A6	12/6
6N7	12/6	12SG7	12/6
6SH7	10/-	12SK7	12/6
6SH7GT	10/-	12SR7	12/6
6SK7	15/-	EA50	7/6
6SN7	19/6	RL37	10/-
6SS7	12/6	VT90 Micro-pup	10/-
7193	8/6		
807	10/-		

METERS

250-0-250 microamp 3" flush	35/-
0-1 M.A. 3" flush	25/-
0-1.5 M.A. 3" flush	25/-
0-50 M.A. 2" flush	15/-
0-300 volt A.C. 3" flush	35/-
0-350 M.A. R.F. Thermocouple	15/-
0-1 amp. R.F. Thermocouple	15/-
0-300 M.A.—0-600 volt, dual reading, 1.5 M.A. 3" flush with shunts	30/-
0-100 M.A. 0-2000 volt dual reading 1 M.A. 3" flush with shunts	30/-
030 M.A. 0-5000 volt dual reading, 1 M.A. 3" flush with shunts	30/-
0-10 amp. D.C. 3" protruding	30/-

Post N.S.W. 9d; Interstate, 1/3.

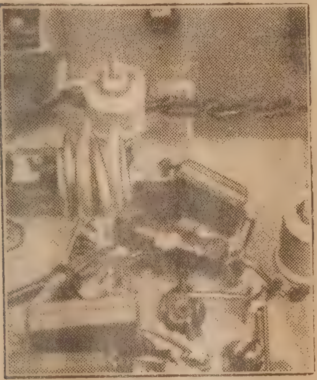
ELECTRONIC EQUIPMENT CO.

LM3555. 29b WEST STREET, LEWISHAM, SYDNEY. (Opposite end of Lewisham Hospital, adjoining railway line). LM3555.

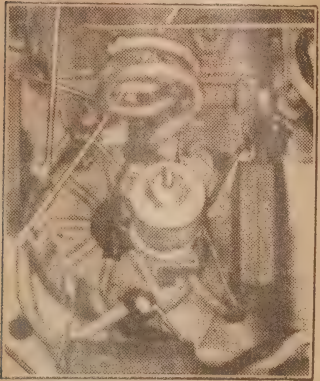
alignment procedure by one or other of the methods outlined, tune carefully across the FM station and note the position and strength of the side responses.

If they are both about the same strength, both equally displaced from the main response and both weaker than it, it is a good indication that the discriminator transformer is balanced.

If, however, one side response is closer than the other to the main response, the discriminator balance is poor and must be corrected by screwing the slug in or out to vary the inductance of the smaller half of the winding. Varying the slug will, of course, necessitate altering the trimmer to maintain resonance.



Close-up of the mixer socket. Note 2-turn grid coil mounted on tag strip, with single-turn primary close alongside.



And here is the oscillator socket. Disregard the suppressor lead, which was wrongly placed when this photograph was taken.

If the spurious response on the high side is closer to the main response, it is generally an indication that the balancing slug is too far out. Screw the slug in a couple of turns, reset the secondary trimmer by one of the methods already outlined and check again the balance of the responses. By this process of trial and error, it should be possible to get them spaced fairly evenly on either side of the main response.

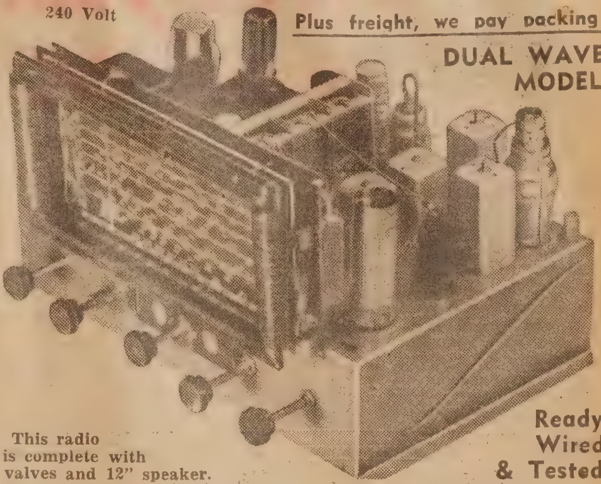
(Continued on Page 70)

8 Valve Radio Chassis £28/15/-

240 Volt

Plus freight, we pay packing

DUAL WAVE MODEL



This radio is complete with valves and 12" speaker.

Ready Wired & Tested

Special Purchase
Limited quantity Ferrotune B/C tuning and coil units. Dial and escutcheon plate. Chassis 4/5 valve A/C type. 2 I.F. transformers, Model KF.T.3 iron cored. 35/-

"RAYRESIN" PLASTIC RODS and SHEETS
Available in all sizes and shapes—in clear and opaque colors—Enquiries invited.

THE ALL ELECTRIC RECORD PLAYER

This portable unit is housed in a leatherette covered carrying case, and fitted with magnetic pick-up and electric motor and measures 14" x 12" x 6" when closed. Plays 10" or 12" records. Ideal for connecting to your present radio pick-up terminals.

Price £9/18/-

Also available in metal brocade-finished unit without portable carrying case.
Price £8.19.0

240-volt 50 cycle Phono-motor and turntable.
PRICE £4/10/-

WANTED: Radio mechanic. Also shop assistant. Apply by letter to the manager.

RADIO HOUSE PTY. LTD.
296 PITT STREET, SYDNEY
Branch, 6 Royal Arcade, Sydney

Here's your answer, Tom!

The original Tom was a real life character. His questions—and our answers—have appealed to many other readers and we are therefore planning to continue this as a regular feature. If you, like Tom, have come up against questions which puzzle you, set them out on a sheet of paper, head it "Your Answer Tom" and address it to the Technical Editor, Radio & Hobbies, Box 2728C., GPO, Sydney. We won't publish your name and address, but sign your letter as a mark of good faith. Meantime, here are a variety of questions and answers selected at random from our mail.

SO for our first question:—

1. Is there any possible way of reducing a 100 milliamp choke to 40 milliamps and a 385 volt power transformer to 325 volt?

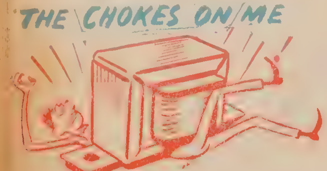
Technical "long-hairs" might smile at these two questions, Tom, but don't be put off by that. You can take it from us that they crop up quite frequently. First of all, the choke and its ratings.

The 100 milliamp rating, applied to a filter choke, indicates that the choke has been designed to carry a total current up to 100 milliamps. If substantially more than 100 milliamps is passed through it, the winding may tend to heat up and, in an extreme case, ultimately to become [illegible]

At the same time, the excessive current will tend to "saturate" the iron core and to reduce the inductance and filtering effect to something much lower than it is supposed to be.

Conversely, if the current through the winding is less than 100 milliamps, the inductance and filtering efficiency will tend to rise, which is all to the good. Also there will be less heating effect and very little chance of the choke burning out.

The only reason why one does not specify large chokes everywhere in a receiver is that they are more bulky and more costly, and in this we are more loyal to readers' pockets than dealers' accounts. So, Tom, if you have a 100 milliamp choke and it will fit into the available space, you can go ahead and use it to advantage even though, apparently, your receiver only draws 40 milliamps.



The current rating of a power transformer is much the same story, and there is similiarly no objection to using a 100 milliamp transformer with only a 40 milliamp load. The only slight complication is that the transformer might deliver a trifle higher voltage under reduced load, but this is not likely to be high enough to cause trouble in an average design.

The voltage rating is another thing and, short of removing turns from the secondary (horrible thought!), one can't do a single thing about the excessive voltage. In your case you have 60 volts too many from the transformer, and there will be at least that many volts in excess of your d-c requirements. Thus, using a 385 volt transformer in place of a 325 volt transformer, without alteration to the circuit, would make things very difficult for the valves and components in the set.

To be on the safe side, you must insert a heavy duty resistor somewhere in the filter system to get rid of the excessive voltage and, incidentally, mount it sufficiently in the clear to avoid possibility of melting all the wax from the surrounding condensers.

Assuming that the excess voltage is 60 and that the current is 40, a resistor of 1500 ohms, 10 watts would have to be connected in series with one end of the filter choke. Better still, one of about 1000 ohms at the same wattage could be connected between the output of the rectifier and the junction of the first filter condenser and filter choke. This makes things easier both for the rectifier and the first filter condenser.

So much for that question.

I.F. TRANSFORMERS

I also want to know whether 455Kc IF transformers will replace 465Kc transformers and what changes, if any, have to be made in the circuit.

Your third question is one we have been called upon to answer very frequently of late. It all came about because the local authorities agreed to keep frequency of 455Kc clear of radio transmission to avoid interference in the IF channels of superhet receivers. Therefore, we, like other interested parties, began to mark IF transformers and circuits with the figure 455Kc, whereas before, the more usual figure was 465Kc. Occasionally, the good old habit persists, and 465Kc is mentioned instead of 455, or vice versa.

Fortunately there is little or nothing to it, because the difference between 455 and 465Kc involves nothing more than a slight adjustment to the core or trimmers. Thus one can set the same transformer to either frequency by screwing the trimmers in or out a couple of turns.

HUM TROUBLE
?

So, Tom, you can forget your worries about 455 and 465Kc.

There ain't any difference worth speakin' of!

FIRST VALVE SET

I am very keen on building a wireless receiver, but it would need to be as simple as possible, since it would be my first attempt on construction outside of crystal sets. I am fifteen miles from the nearest radio station and about 70 miles from Melbourne.

Well, Tom, having constructed several crystal sets, you will at least have gained an elementary knowledge of circuit symbols and radio components. Passing on to a valve set, you will need to learn something of batteries, filament circuits, reaction, &c.

If you had mentioned that you had certain old parts and valves on hand we would normally have suggested building a conventional one or two valve set using old four-pin triodes. However, you will apparently need to buy new parts and your money would be much better spent in purchasing more modern valves like the 1K5-G, which sells new, ex-disposals, for about 10/-. It is a far better valve than any of the old triodes ever knew how to be!

Back in the May, 1947, issue we described a set using 1K5-Gs, calling it the "1K5-Four." Then in the four subsequent issues we described how it could be built up progressively as a one-valve, two-valve, three-valve and then a four-valve version. We suggest that this would be ideal for your purpose.

Concerning your location, you should not have the slightest difficulty in receiving your local station at very loud headphone strength on the two-valve version, while the more distant Melbourne stations should also be heard well. Even the one-valve version should do a good job, but start off with the two valves if you can manage it.

All set?

PLUG-IN COILS

I had a look at one of your one-valve circuits, I forget now what you called it, and noticed that it used a commercial coil. Is there any special difficulty about using a home-made coil in a small set?

No, Tom, there is no special difficulty about using hand-wound coils, except where you are trying to build the set into the smallest possible space. In the ordinary way it is impossible to wind an efficient coil as small as the manufacturers can make them, but, where they can be coiled on a 1¼in. former or larger, the hand-wound coil can be perfectly satisfactory.

You could stand to learn quite a few valuable lessons by observing the effect of varying the number of turns on the respective windings. We have a page of coil data which suggests specifications for coils to cover both the broadcast and short-wave bands. If you haven't seen the data in earlier issues we can always send you a copy through the shilling query service.

CONNECTIONS

The main point to watch when making hand-wound coils is that you bring out the various connections to the pins on the coil former and then wire the coil socket in appropriate fashion so that all the windings are connected correctly to the rest of the circuit.

Once having wound the various coils and adjusted them for best results it is simply a matter of plugging in one or the other to tune on any desired wave band.

If you want to try a commercial coil in the same receiver it is not a very difficult matter to connect leads to the lugs and slip it down inside a blank coil former with the pin connections made in such a way that it corresponds with the wiring of the socket. By this means you can use your set with either a home-wound or commercial broadcast coil and as many other coils as you care to wind up.

LOUDSPEAKERS

Can an old horn speaker be used with a modern receiver and, if so, how is it connected?

Well, Tom, the old horn speakers go back into the early twenties when standards of radio listening were very different from what they are today. What we accepted then as "remarkably clear" would be intolerably "tinny" today.

In the first place, therefore, anyone who contrives to use an old horn speaker must be content with the standards for which it was originally built. One will understand speech and recognise tunes but there can be no pretence to fidelity.

The sensitivity will also be low—that is, the volume of sound will not be as high for a given electrical input as with a modern speaker. After all, a horn speaker is only a glorified earphone provided with a flare to feed the sound waves into the free space of a room.

WATCH CURRENT

Electrically, the old horn speakers were meant to handle only a very limited amount of energy and to carry the plate current of a battery triode, amounting to some five to ten milliamps. It is therefore safe enough to use them on battery sets where they will still have to carry only about the same amount of current. But remember, as we said before, that they are insensitive and tinny by modern standards.

For most a-c sets, you can count out the old horn speaker. Even if you overcome the problem of substituting for the field coil—where such is required—the 30 odd milliamps of plate current which is drawn by the normal a-c power valve would very soon burn out the winding.

Some form of shunt feed can be arranged to keep the plate current of the speaker down but, by the time you provide a suitable choke and condenser, you would be half-way to the price of a new dynamic speaker. Cut down on smokes for the next fortnight and the new speaker is as good as yours!

Just in case any of your pals read this, Tom, much the same remarks apply to cone speakers of the older sort. True, they were a step in the right direction, but what we said about tinny reproduction, low efficiency and windings which burn out, still goes!

Cheerio, Tom, till next month.

Aircraft Industry Adopts Standards in Aluminium

WEST COAST (USA) aircraft manufacturers will work from a new "Warehouse Stock List," developed by the National Aircraft Standards Committee to simplify design and materials ordering. In aluminium sheeting, for instance, one 48 x 144 in. sheet in one finish will be standard instead of three or four sizes and finishes. One size, finish, and temper of tubing will be used instead of eight. Diameter and wall-thickness of tubing are standardised.

Northrup Aircraft, Inc., has reduced the number of stockroom items 40% below last year, as standardisation has made ordering faster and more certain. The committee will revise the list continuously and is preparing a list to cover brass and copper items.—Business Wk.

BASSIN'S RADIO EXCHANGE

65-67 WILLIAM ST., SYDNEY
Cnr. Riley St. MA8146.

Communications Receivers

NATIONAL NC-2HD-40. 1948 MODEL
New. 12 valves, Xtal, 31,000 Kc to 550 Kc. 10 bands. Bandspread. 240 v. With special National Speaker. Both in original cartons. Best offer. Write for price and particulars.

NATIONAL HRO JNR. in good condition. Chassis, valves and coils. A good receiver.

STC-AMR300. In new condition. Complete with speaker. Covers BC band.

KINGSLEY AR7, ex-Kingsley factory. New type valves and 10-20m. Bandspread. Coils. As new.

BC348-Q. As new. With 28v Genemotor. Complete with valves and Xtal.

BC348-P. Original condition. Complete with valves and Xtal. 28v. DC.

R.C.A. 77E in first-class condition. Complete with valves and special R.C.A. speaker.

HALLICRAFTERS S-29. As new AC-DC and Batteries. With charging unit. 10 to 550 m. Bandspread. B.F.O.

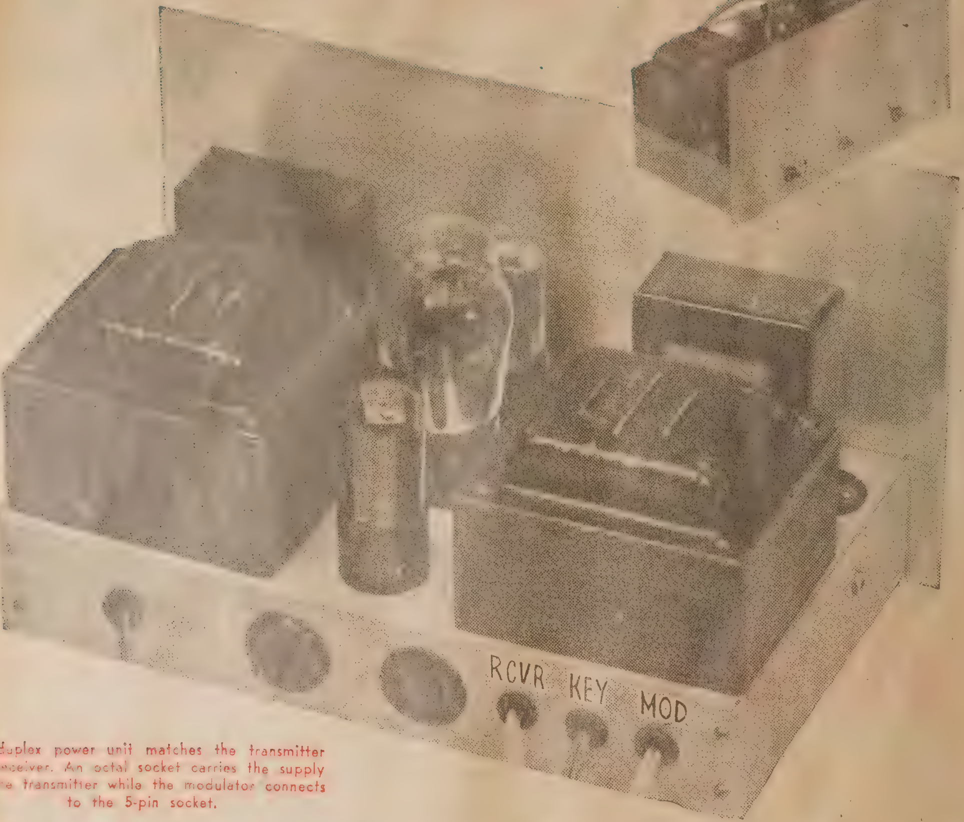
PHILIPS R163. In good condition. 13 to 550 m. B.F.O., A.V.C., etc.

AR8. In good condition. Complete with valves.

SPECIAL 10v. DX CHASSIS with speaker. Complete with valves. New.

WANTED American Communications Receivers. Highest price paid for first-class equipment.

BASSIN'S RADIO EXCHANGE
65-67 WILLIAM ST.,
SYDNEY.
CNR. RILEY ST., MA8146



The duplex power unit matches the transmitter and receiver. An octal socket carries the supply for the transmitter while the modulator connects to the 5-pin socket.

TRANSMITTER POWER UNIT

Third unit in our series for the new amateur is this duplex power supply. It uses standard components throughout but employs a system of switching which gives full send/receive control for either phone or C.W.

THERE is always a tendency to dismiss a small power supply as a conventional combination of equally conventional components. From this attitude comes many a rough and a chirpy signal.

The initial requirement in this case was for a unit to supply the small transmitter described last month. A supply which used conventional components and physically similar in size and shape.

Looking ahead, we realised that a modulator would also have to be built and a check on the necessary components showed that it would not be advisable to try to cram all the necessary components on to the same small chassis.

Our power unit therefore carries the modulator power supply as well, and thus simultaneously minimises the chances of trouble with hum and feedback. The chassis is well filled with components, but not to the point of being overcrowded.

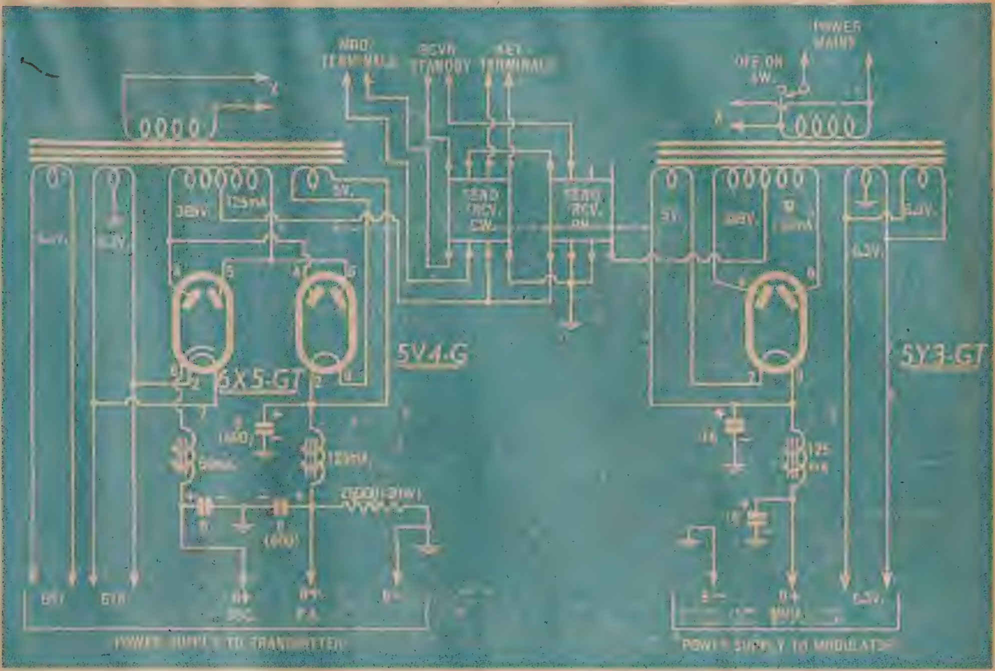
Actually, the individual constructor can begin by installing only that section of the circuit which supplies the transmitter proper, leaving the modulator supply to be added when the modulator is built.

Referring first to the transmitter power supply, one of the chief requirements is to provide a well regulated supply voltage for the tritet oscillator, so that its operating conditions do not alter appreciably as the key is opened and closed.

With a conventional condenser-input filter, common to both sections of the transmitter, the tritet high tension supply is likely to vary by up to 100 volts as the key is operated. The effect of this on some crystals could be tragic, while others would tend to "chirp" badly.

To overcome the difficulty one can use a choke-input filter, but a bulkier and more costly transformer would be required to deliver sufficient volts for the final amplifier.

A voltage regulator tube is another



At first glance the circuit looks complicated but the switching gives complete control of both receiver and transmitter. Main feature of the unit is the stability of the oscillator supply voltage. Power is available also to operate a class AB! modulator. At the outset, the modulator supply could be omitted, the unit being built up to include only the section of the circuit on the left. The 6X5-GT and its choke input filter supplies the crystal oscillator, while the 5V4-G supplies the 807 final amplifier.

possibility, but these are not always readily available, and also impose additional loading on the supply.

The scheme we suggest is not necessarily original, but is the one which, we feel, deserves more frequent attention.

It involves the use of two separate rectifiers operating from a common receiver type transformer delivering 385 to 400 volts per side at 125 milliamps.

A 5V4-G rectifier and a conventional condenser input filter system provides just over 400 volts for the 807 final amplifier at a current of 80 odd milliamps. It is thus possible to operate the transmitter with something over 30 watts input to the final, either phone or C.W.

With the key open, the only drain on the supply is that provided by the 25,000 ohm 20 watt bleed resistor, and naturally the filter condensers charge up to a much higher voltage. That is why we specify 600 P.V. types or, better still, 525 P.V. 16mfd. condensers connected in series for the input side of the filter.

This variation in voltage, however, is not passed on to the tritet, since its supply is derived from a separate 6X5-GT rectifier operating from the same high tension secondary, but

PARTS LIST

FOR THE POWER SUPPLY:—

1 Chassis 11" x 6" x 2".
1 panel 12" x 6¾".
2 Power transformers; 385/385 125mA, 6.3v 3A, 6.3v C.T. 3A, 5v 2A.
2 125 mA filter chokes.
1 60mA 14 H. filter choke.
2 D.P.D.T. toggle switches.
1 S.P.S.T. toggle switch.
2 8 mfd 600v electrolytic conds.
1 8 mfd 525v electrolytic cond.
2 16 mfd 525 or 600v electrolytic cond.
1 25,000 ohm 20 watt W.W. resistor.
4 octal valve sockets.
1 5 pin valve socket
1 octal plug.
1 5 pin plug.

VALVES:
1 6X5 GT, 1 5Y3 GT, 1 5V4 G or 5U4 G.

SUNDRIES:
4 rubber grommets, 3 position tag strip, hook-up wire, nuts and bolts, power flex, &c.

FOR THE TRANSMITTER:—

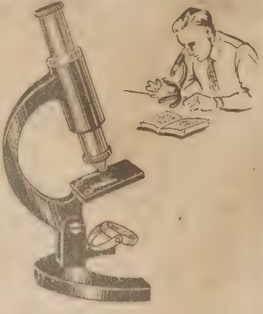
1 chassis 11" x 6" x 2".
1 front panel 12" x 6¾".
1 mounting bracket for 807 valve.
6 .01 mfd mica cond.
2 .001 mfd mica cond.
2 100mmf mica cond.
1 50 mmf mica cond.
2 3-30 mmf air trimmers.
2 100 mmf midget variable cond.
2 .05 meg 1 watt resistors.
1 .02 meg 1 watt resistor.
1 .02 meg 2 watt resistor.
1 1000 ohm 1 watt resistor.
1 200 ohm 1 watt resistor.
1 100 ohm 1 watt resistor.
1 90 ohm 1 watt resistor.
1 50 ohm 3 watt W.W. resistor.
1 11.1 ohm 3 watt W.W. resistor.
1 5.3 ohm 3 watt W.W. resistor.
2 octal valve sockets.
2 6 pin valve sockets.
2 5 pin valve sockets.
1 4 pin valve socket.
1 octal plug.
5 1½" dia. 6-pin coil formers.
3 4-pin valve bases.
1 5 position 2 circuit rotary switch.
2 indicator plates.
3 small pointer knobs.
6 insulated terminals (5 red, 1 black).
1 0-5 mA meter (3" or 2").

VALVES: 1 6V6-GT, 1 807.

CRYSTALS: To suit.

SUNDRIES:
Nuts and bolts, hook-up wire, enamel wire for coils, solder lugs, solder, &c.

Students' MICROSCOPES



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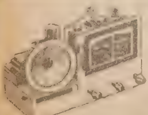

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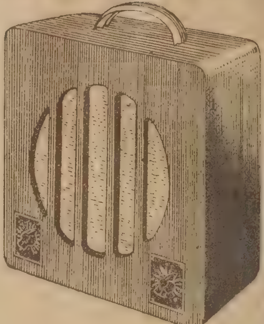

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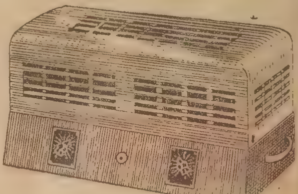

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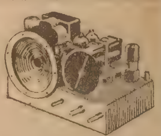

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into its own separate choke-input filter. Actually this can be any small oddment choke and a single electrolytic, so that the total additional outlay need only be quite small.

The advantages, however, are immediately obvious in that the variation in tritet supply is reduced to negligible proportions. In the original supply, it was 290, with the key down, and 310 with the key up. The nett effect of this slight variation in voltage and the loading on the tritet is not likely to produce chirps.

A USEFUL CIRCUIT

The same circuit arrangement is applicable, of course, to other equipment where a separate lower voltage and well regulated supply is required. The screen supply of a class AB2 modulator stage is a notable example. The second rectifier must, of course, be rated to operate with the full H.T. on its plates, although even this rating is less restrictive where the valve is operating into a choke-input filter.

The modulator supply is perfectly conventional, involving an identical 385 volt 125 milliamp power transformer, a 125mA choke, and a couple of electrolytics.

Although the modulator has not actually been constructed at the time of writing, we have envisaged a conventional arrangement using a 6SJ7 pentode amplifier, phase splitter and a couple of 807 valves in class AB1. No more than 17 odd watts will be needed, and requirements of voltage, current and regulation are therefore quite moderate.

We have therefore specified a 5Y3-G rectifier, which is the cheapest of the bunch but nevertheless adequate to the task.

A single 6.3 volt winding will supply all heaters in the modulator, but it is most important that the transformer supplying the transmitter have two 6.3 volt windings, as well as the 5.0 volt rectifier winding. One of the 6.3 volt windings is earthed, and supplies the 6V6-GT tritet and the associated 6X5-GT rectifier. The other winding supplies the heater of the 807 and is tied to its cathode.

If this were not done, upwards of 450 volts would be imposed between heater and cathode of the 807 under key-up conditions.

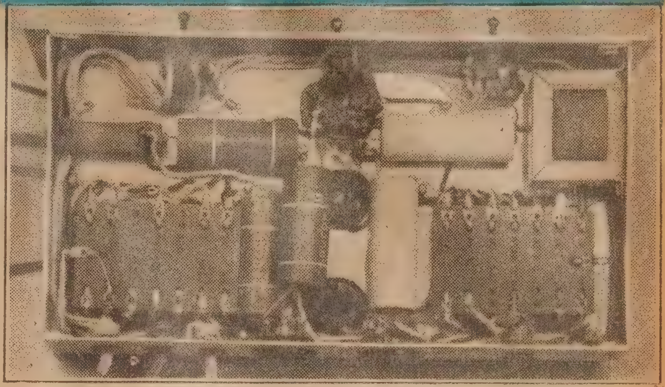
CENTRALISED CONTROL

The switching may at first glance appear unduly complicated. but only because it is all concentrated in the power supply chassis.

In the normal way one might have a "standby" switch on the receiver and another to short the key for phone operation. Some other operation might be needed to short the modulation transformer for CW operation, not forgetting the power switch on the wall. In this design all functions have been combined in three switches on the power chassis.

The centre switch is a simple SPST unit which applies the mains voltage to the transformer primaries All heaters come up to operating temperature, but the transmitter will not operate until one of the other toggle switches is depressed.

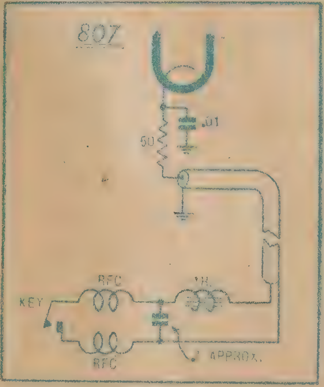
THE UNDER-CHASSIS WIRING



The space beneath the chassis is fully occupied but not overcrowded. It is possible to build the transmitter supply only to begin with, adding the modulator supply when required.

These other switches are actually DPDT types—a little more expensive to buy, but made to serve a very useful purpose.

The back contacts on each switch are wired in series and are intended to connect, via a length of twin plastic flex, in series with the high tension CT return on the receiver power supply. Thus, when both switches are in the "up" position, the high tension circuit is closed and the receiver operates. When either switch is depressed, the receiver is rendered inoperative.



Although tests indicated that key clicks were not troublesome, a complete click filter may be added, as shown.

One switch—on the left in the circuit and on the panel—serves as the send/receive switch for CW, while its counterpart on the right-hand side is for send/receive on phone.

The remaining "back" contacts on the CW switch are connected to the key terminals of the transmitter so that they are shorted out whenever the switch is in the up position.

Depressing the CW switch, therefore, cuts off the receiver, turns on the transmitter power supply an leaves the key terminals open read for CW transmission. At the sam time, the secondary of the modulation transformer is shorted out.

For phone transmission, the CW switch is left in the up position an the phone switch is depressed. Thi renders the receiver inoperative an switches on both transmitter an modulator. Meanwhile, the key contacts are shorted across by the bac contacts of the other switch.

Thus, actual working on eithe phone or CW requires only the manipulation of a single switch for send receive control.

AERIAL CHANGEOVER

Where a single aerial is use change-over could be arranged b means of a standard relay operatin from the plate current of the trit oscillator, or from the high tensio current of the receiver.

Physically, the supply is assembled on a chassis measuring 11i x 6in. x 2in., with a 12in. x 6¾i front panel. The position of a components is obvious from th photographs. The transmitter supply components are grouped at th right, with the modulator compon ents at the left. The main 5V4- rectifier is in the centre, with th 6X5-GT towards the front and th 5Y3-G at the back.

The transformers should be on medium-sized lamination, while is necessary also to use chokes having moderate over-all dimensions. N undue difficulty will then be experienced in accommodating a components.

Power connections to the transmitter and modulator are by means o a plug and socket system, while th leads to the transmitter key term nals, the modulator terminals, an the receiver are lengths of twin plastic flex, run out the back of th chassis through rubber grommets.

Needless to say, they should b clearly marked to avoid possib confusion.

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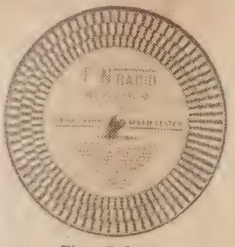

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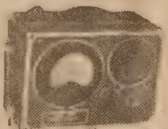

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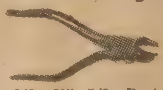

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2X2	12/9	6C5	19/3	6SK7	18/4		
3S4	20/6	6F6	17/10	6SN7	23/6		
3V4	20/6	6F8	21/3	6SS7	18/9		
5U4	19/3	6G6	20/9	6SQ7	18/4		
5V4	19/10	6H6	19/3	6V6	18/10		
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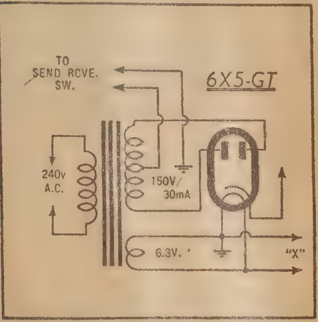
By way of conclusion, a few words may not be amiss on the subject of key click filters. As most readers will know, the abrupt make and break of the key contacts can produce transients which may cause interference in nearby receivers or spread interference into neighboring channels.

A careful check of last month's transmitter indicated that the signal on CW was completely clean without any form of filtering in the key circuit—no chirps and no clicks. The freedom from chirp is, of course, due mainly to the well regulated oscillator supply, while the cathode bias circuit would assist materially in minimising key clicks.

While there is therefore no reason to expect trouble on this score, there is no objection to adding a conventional filter by way of additional precaution.



The control lead is wired into the receiver power supply as shown. The receiver will not operate until the circuit is closed.

An RF filter consists normally of a pair of RF chokes, one in each lead, bypassed at the transmitter end with a condenser ranging in value from about .001 mfd to 0.1 mfd. Chokes of fairly high inductance—upwards of 2.5 mH—are to be preferred, while the condenser value is best chosen by trial and error.

In some cases it is helpful also to bypass the key contacts directly with a small condenser of 100pf or thereabouts.

The RF choke in the "earthy" side of the circuit may not be needed, particularly if the keying lead is a piece of shielded wire or coax cable, as suggested in the original circuit.

The signal pulse can be rounded off, if desired, by the insertion of a large inductance in series with the active lead, the normal value being about 1 henry. An iron-cored choke of the type used in filament circuits suggests itself for the purpose.

Increasing the inductance value will round off the beginning of the pulse while the end of the pulse is "softened" by increasing the values of "C" in the circuit.

When the transmitter is put on the air, one of the first jobs should be to check the keying characteristics, preferably with a fellow amateur situated fairly close by.

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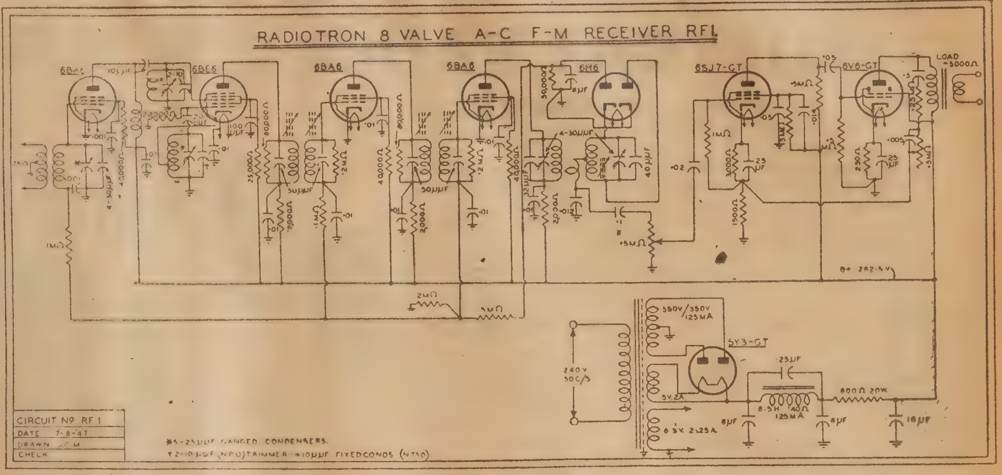
THE RADIOTRON F.M. RECEIVER


RADIOTRON 8 VALVE A-C F-M RECEIVER RF1
6BA6
6BE6
6BA6
6BA6
6H6
6SJ7-GT
6V6-GT
5Y3-GT
10μμF
2-10
100 μμF
.001
.01
4-30μμF
40,000Ω
25,000Ω
80,000Ω
50μμF
2000Ω
.2MΩ
.1MΩ
40,000Ω
30,000Ω
8μF
4-30μμF
40μμF
32μμF
2000Ω
.012
.02
.5MΩ
1MΩ
3000Ω
25 μF
1500Ω
.05
.014
.5MΩ
.005
250Ω
.25
.3
LOAD =5000Ω
B+ 282.5V
2MΩ
1MΩ
350V/350V 125MA
240V 50C/S
5V.2A
6.3V. 2.25A.
.25μF
8.5H 40Ω 125MA
8μF
8μF
800Ω 20W.
16μF
CIRCUIT N° RF 1
DATE 7-8-47
DRAWN
CHECK
*5-25μμF GANGED CONDENSERS.
†2-10μμF (NPO)TRIMMER +10μμF FIXEDCONDS (N750)

Here is the complete Radiotron circuit. While technically an excellent design, it would involve considerable outlay and the purchase of valves which are in very short supply. High grade F.M. receivers, when they eventuate, will doubtless follow this general pattern.

"Radiotronics" 127 features an excellent article on the construction of an eight-valve F.M. receiver. It shows very clearly what is involved in a full-scale design and therefore makes an interesting contrast with our own tuner on page 24 of this issue. Full coil data is given, together with details of the I.F. transformers. These are sufficiently straightforward in design to permit their manufacture in the home

IT is not possible, within the available space, to reprint the original article in its entirety, but it is possible to outline the comments of the designer on the various portions of the circuit.

The receiver should cover the signal frequency range of from 88 to 108Mc. with an additional 0.5Mc. at each end of the band to provide overlap. The intermediate frequency is 10.7Mc., making the oscillator coverage 98.2 to 119.2Mc.

The essential details of the aerial coil are shown in the diagram, the coil in the original set being tuned by one section of a 5 to 25pf 3-gang condenser. It would be possible to provide fixed tuning of the aerial circuit, the maximum loss likely to result being in the ratio of 2:1.

R.F. AMPLIFIER

The 6BA6 serves as the RF amplifier in a circuit arrangement more or less conventional for UHF. It is coupled to the mixer grid by a 10pf. condenser, which represents the best balance between gain variation and stray capacitance loading across the tuned circuit.

The R.F. plate choke consists of $6\frac{1}{4}$ turns of 22 B&S enamel wire wound on a 9/16 inch former over a length of 3-8in. Details of the R.F. coil itself are given in the diagram, the coil being self-supporting and adjusted for inductance by varying the spacing.

FREQUENCY CHANGER

The frequency changer is a 6BE6 used with a cathode tapped oscillator circuit. It is noteworthy that the oscillator "coil" is nothing more than a length of lead bent to the arc of a circle and soldered across the oscillator section of the gang. The length of wire governs the frequency coverage while the position of the cathode tap provides control over the oscillator grid current and therefore the signal-to-noise ratio.

It was found possible to eliminate the padding capacitance while maintaining two point racking at 88 and 108Mc. The loss of gain at the centre of the band proved to be about 0.5db only. The filament R.F. chokes were found to be unnecessary, but it is desirable to bypass the heater to earth with a 0.01 mfd condenser. Frequency shift due to heating or variation in line voltage was found to be very small.

The I.F. transformers are intended to have a "Q" factor of 75.2 for both primary and secondary, necessitating an 80,000 ohm damping resistor in each case. Allowing fo the parallel input resistance of th 6BA6 I.F. amplifier, the secondar loading resistor actually has to b made 0.2 meg. The coupling between windings is intended to b 0.95 of critical, as determined wit a "Q" meter.

Under these conditions the I.F stage gain was measured at 38 a compared with 41.1, which was calculated on the published transconductance of the 6BA6 amplifier.

The design of the ratio detecto transformer is quite critical, sinc it largely determines the ultimat characteristics of the receiver. Ful details of its constructions are given

DETECTOR LOAD

It will be noted that the load fo the ratio detector has been set a 50,000 ohms, which represents compromise between audio signa voltage and distortion level. Highe values give an increase in sensitivit almost directly proportional to th increase in resistance with, howeve an increase in distortion. - By wa of an example, it was found that 1. millivolts at I.F. (deviated 75kc.) applied to the 6BA6 driver stage gri

AN APOLOGY —May we be permitted to apologise to those who have waited so long for this kit of coils.
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- 1 only "Q Plus" Q+RC2S R.F. coil.
- 1 only ignition hash coil.
- 1 pair "Q Plus" midget I.F. Transformers.

Complete with recommended circuit and a host of construction tips.
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SPECIFICATIONS

Size:—
Aerial, RF & Oscillator Coils—¾" x ¾" x 1½".
I.F. Transformers, ¾" x ¾" x 2".
Phantom Drawing showing 2/3 size "Q Plus" midget coil construction.

CONSTRUCTION

All coils are Litz wound, permeability tuned with iron pot surrounds — Can specially lined with iron dust to increase efficiency.

Single hole mounting with special flush solder lugs, for small chassis.

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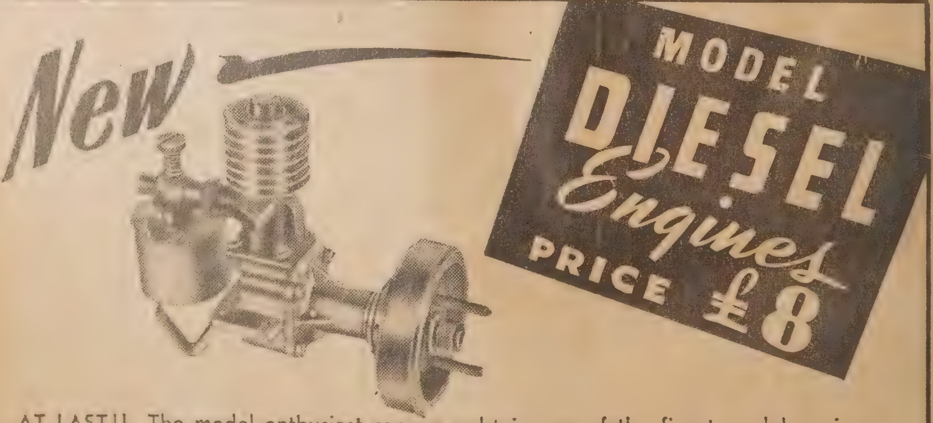

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gave 50mW of output power using a 50,000 ohm diode load. For a 30,000 ohm load the input required for the same output was 30 millivolts.

Band width of the complete detector circuit measured with an A.M. generator showed peaks of output at 10.86 and 10.54Mc., giving a total band width of 320Kc. However, the band width under dynamic conditions varies with input due to the different loading imposed by the ratio detector on its associate transformer.

A.M. NOISE

A series of tests carried out with A.M. equipment indicated a notable advantage on the part of ratio detector in rejecting A.M. noises as compared with a conventional discriminator. However, the methods employed were subject to sufficient variation and error to render the results worthwhile only as a general guide.

The audio amplifier is fairly conventional and basically similar to one published previously with a Radiotron A.M. receiver design (circuit RC52). However, it was found desirable to increase the gain by reducing the feedback which, in turn, reduces the maximum bass boost available to 6db at 60c/s.

Bass boost seemed desirable on listening tests to balance the extended treble response. Another point of note was that treble attenuation appeared desirable when listening to many ordinary recordings as the record hiss is rather objectionable. Tests of the audio amplifier give a response level within 1½db from 50c/s to 15Kc at power level of ½ watt. Distortion tests at the same level indicated that the distortion was less than 1 per cent total up to a limit of 7500 c/s, as set by the measuring equipment.

TREBLE CUT

The .012 mfd bypass condenser across the volume control provides the necessary 75 microsecond de-emphasis necessary to offset the pre-emphasis at the transmitting end.

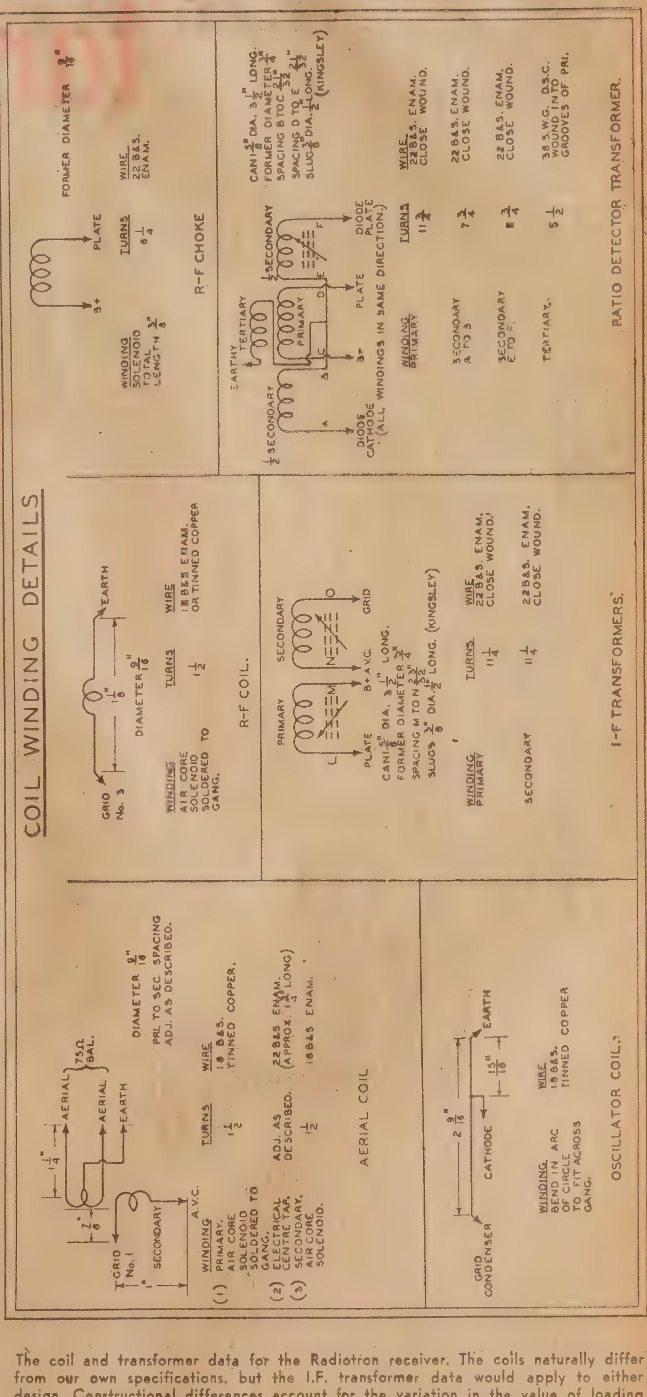
Hum neutralisation is provided by the .014 mfd condenser connected across the screen supply resistor, the capacitance value being quite critical. It was found desirable also to tune the filter choke with a .25 mfd condenser—again a value which is critical and must be discovered experimentally. Higher capacitance electrolytic condensers are suggested as a further possible precaution against hum.

Summarising the test results, the filtered high tension voltage is 262.5 at 103 milliamps. At a signal frequency of 88 Mc the oscillator grid current was 205 uA, at 98 Mc 225 uA, and 180 uA at 108 Mc.

Assuming a 75 ohm input channel, an input voltage of between 5 and 7 uV was necessary to give an output of 50 milliwatts—this on the assumption of a 75 Kc deviation at 400 c/s.

Characteristics of the audio amplifier have already been outlined.

I.F. TRANSFORMER & COIL DATA


COIL WINDING DETAILS
FORMER DIAMETER 3/16"
PLATE
B+
WINDING SOLENOID TOTAL LENGTH 3/8"
TURNS 6 1/4
WIRE 22 B&S. ENAM.
R-F CHOKE
CAN 1 3/8" DIA. 3 1/2" LONG.
FORMER DIAMETER 3/4"
SPACING B TO C 21/32"
SPACING D TO E 21/32"
SLUG 3/8" DIA. 1/2" LONG. (KINGSLEY)
TERTIARY
EARTHY
1/2 SECONDARY
PRIMARY
1/2 SECONDARY
B+
PLATE
DIODE PLATE
DIODE CATHODE
(ALL WINDINGS IN SAME DIRECTION.)
WINDING PRIMARY — TURNS 11 3/4 — WIRE 22 B&S. ENAM. CLOSE WOUND.
SECONDARY A TO B — 7 3/4 — 22 B&S. ENAM. CLOSE WOUND.
SECONDARY E TO F — 7 3/4 — 22 B&S. ENAM. CLOSE WOUND.
TERTIARY — 5 1/2 — 38 S.W.G. D.S.C. WOUND INTO GROOVES OF PRI.
RATIO DETECTOR TRANSFORMER.
GRID No. 3
EARTH
1 1/8"
DIAMETER 9/16"
WINDING AIR CORE SOLENOID SOLDERED TO GANG.
TURNS 1 1/2
WIRE 18 B&S ENAM. OR TINNED COPPER
R-F COIL.
PRIMARY
SECONDARY
PLATE
B+ A.V.C.
GRID
CAN 1 3/8" DIA. 3 1/2" LONG.
FORMER DIAMETER 3/4"
SPACING M TO N 23/32"
SLUGS 3/8" DIA. 1/2" LONG. (KINGSLEY)
WINDING PRIMARY — TURNS 11 1/4 — WIRE 22 B&S. ENAM. CLOSE WOUND.
SECONDARY — 11 1/4 — 22 B&S. ENAM. CLOSE WOUND.
I-F TRANSFORMERS.
GRID No. 1
SECONDARY
A.V.C.
AERIAL
AERIAL
EARTH
75Ω BAL.
1 1/4"
7/8"
DIAMETER 9/16"
PRI. TO SEC. SPACING ADJ. AS DESCRIBED.
WINDING (1) PRIMARY, AIR CORE SOLENOID SOLDERED TO GANG. — TURNS 1 1/2 — WIRE 18 B&S. TINNED COPPER.
(2) ELECTRICAL CENTRE TAP. — ADJ. AS DESCRIBED. — 22 B&S ENAM. (APPROX. 1 1/4 LONG)
(3) SECONDARY, AIR CORE SOLENOID. — 1 1/2 — 18 B&S ENAM.
AERIAL COIL
GRID CONDENSER
CATHODE
EARTH
2 9/16"
15/16"
WINDING BEND IN ARC OF CIRCLE TO FIT ACROSS GANG.
WIRE 18 B&S. TINNED COPPER
OSCILLATOR COIL.

The coil and transformer data for the Radiotron receiver. The coils naturally differ from our own specifications, but the I.F. transformer data would apply to either design. Constructional differences account for the variation in the value of loading resistors across primary and secondary of the I.F. transformers.

Getting Started On F.M.

Our detailed investigation of FM receiver design brings us this month to a discussion of the Foster-Seeley discriminator—an alternative to the ratio detector. In natural sequence, it is necessary to explain the need for limiter stages and the part they play in the circuit.

UNTIL the advent of the ratio detector, the Foster-Seeley circuit was used almost exclusively in FM receivers and tuners. A survey of current American designs shows it to be still widely used, particularly in the higher priced field, where there is no special urgency to keep to a minimum the total number of valves.

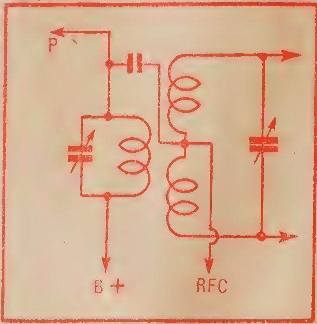
Much discussion has centred around the relative merits and disadvantages of the two circuits, each system finding much authorative support and criticism. However, a recent exhaustive investigation by the BBC Engineering Department failed to make a clear case for either one in preference to the other.

DISCRIMINATOR TRANSFORMER

As in the case of the ratio detector, half the story of the Foster-Seeley circuit is concentrated in the associated discriminator transformer. The function of this was explained at length last month and requires only brief reiteration here.

The transformer has a tuned primary winding and a tuned secondary, the latter normally being split into two equal sections, each having similar coupling to the primary.

A current design, popular in this country at the moment, provides for slightly fewer turns on one-half of the secondary than the other, the lesser half being provided with an iron dust slug, which can be adjusted to give an exact inductive balance.



A discriminator transformer is an essential part of the Foster-Seeley demodulator circuit.

The discriminator transformer usually employed with the Foster-Seeley circuit can be represented as in figure 1a, which is identical with figure 2b in our last issue.

Signals are transferred from primary to secondary both by direct magnetic induction and by capacitive coupling from the plate. The voltages at the two ends of the secondary are the resultant of the two modes of coupling.

When a signal is applied to the transformer of the same frequency as that to which its windings are resonant, the voltages at the two ends of the secondary are equal. However, a deviation in the signal frequency causes phase shift to occur, which upsets the balance, so that the voltage at one end of the secondary becomes higher than the voltage at the other. The degree and direction of unbalance depends, of course, on the degree and direction of signal deviation. This was all covered in detail last month, and reference should be made to the previous article, if the foregoing statements are not understood.

DE-MODULATION

The job of the Foster-Seeley circuit is to resolve the varying conditions of balance and unbalance into an audio frequency signal, similar to that which originally produced them.

The usual circuit arrangement is as shown in figure 2, and its operation is quite easy to understand.

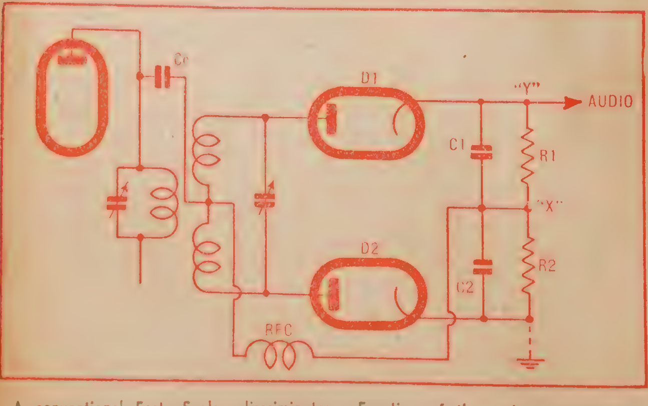
The two ends of the transformer are connected to diode rectifiers, which can well be the sections of a 6H6. Each has its individual diode load and bypass, the return being through an RF choke to the centre of the transformer secondary.

With a resonant input signal, the voltages applied to the two diodes are the same, and, all things being equal, they will develop equal voltages across their respective load circuits R1, C1 and R2, C2.

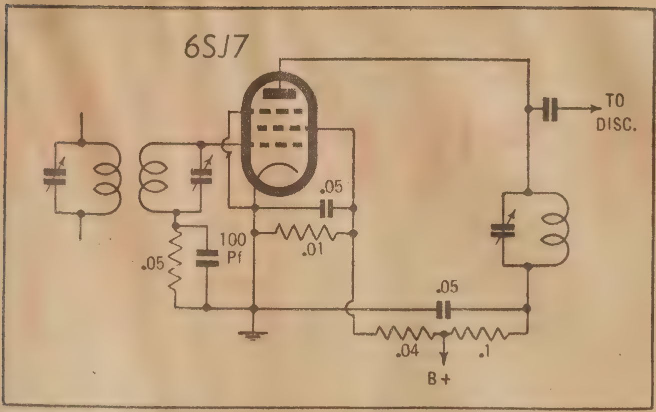
ZERO OUTPUT VOLTS

However, the two loads are effectively in series and, the resultant voltage between the outer ends of R1 and R2 will be zero. For example, if both cathodes are, say, 10 volts positive with respect to the junction of R1, R2 (point X), there will be no potential difference between them.

For purposes of reference, it is convenional to earth one cathode,



A conventional Foster-Seeley discriminator. Function of the various components is explained in the text.



Circuit of a typical limiter stage abstracted from a current American FM receiver design. Note grid-leak bias, low plate and screen voltages.

as shown dotted, so that, with a resonant input signal, the other cathode is also effectively at ground potential.

However, if the signal frequency diviates in a particular direction, the upper diode will receive the greater signal voltage. Therefore, the voltage across R1 will exceed that across R2 The cathode of D1 will be more positive with respect to point "X" than that of D2, so that the resultant will be a positive going audio pulse.

Taking actual figures, if the voltage across R1 increases momentarily from 10 to 12 and that across R2 decreases simultaneously from 10 to 8, then the potential of point "Y" will become 4 volts positive with respect to earth.

On the alternative modulation cycle, when the signal deviates equally in the other direction, the voltage across R1 will decrease from 10 to 8, while that across R2 will increase from 10 to 12. Thus, point "Y" will become 4 volts negative with respect to earth.

EASY TO FOLLOW

The operation of the detector is, therefore, very simple to follow.

However, unlike the ratio detector, the Foster-Seeley circuit is also responsive to amplitude variations, and the reason for this is not difficult to understand.

If, for any reason, the peak value of the incoming signal is increased, so also will be the voltages developed across R1 and R2. Thus, a 20 per cent increase in signal amplitude will produce, at resonance, say, 12 volts across each resistor, and zero potential at point "Y."

But, off resonance, with the same percentage of deviation as before, the voltages across R1 and R2, respectively, will be 14.4 and 9.6, giving an out-of-balance resultant of 4.8 volts instead of 4.0 volts. In other words, a 20 per cent increase in peak signal voltage, off resonance gives a 20 per cent increase in audio signal output. Thus the detector acts very efficiently for amplitude variations—and these would include normal interference signals.

It follows, therefore, that a receiver using the Foster-Seeley discriminator will not be free from AM interference unless special precautions are taken to prevent AM variations reaching the discriminator. This task falls to the so-called "limiter" stages, of which there may be one, two or even three in an extreme case.

Thus, one or more limiters are invariably provided ahead o Foster-Seeley discriminator, but are rarely used in conjunction a ratio detector, which is inher unresponsive to amplitude va tions.

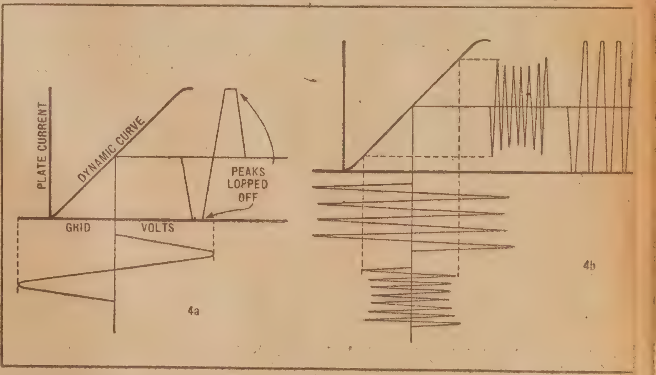
A limiting amplifier looks n the same as an IF amplifier s and, in fact, it is one. However operating conditions are adjuste that it functions normally in an o loaded condition—just the rev to AM practice.

OVERLOAD CONDITIONS

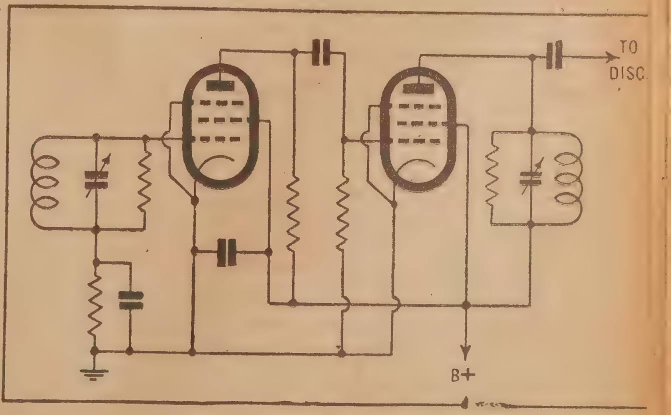
This is achieved by elimin all gain control from the prece stages, so that a very heavy i signal is applied to the limiter The valve itself operates with plate and screen voltages, so th has no chance of dealing propo with the signal fed to it.

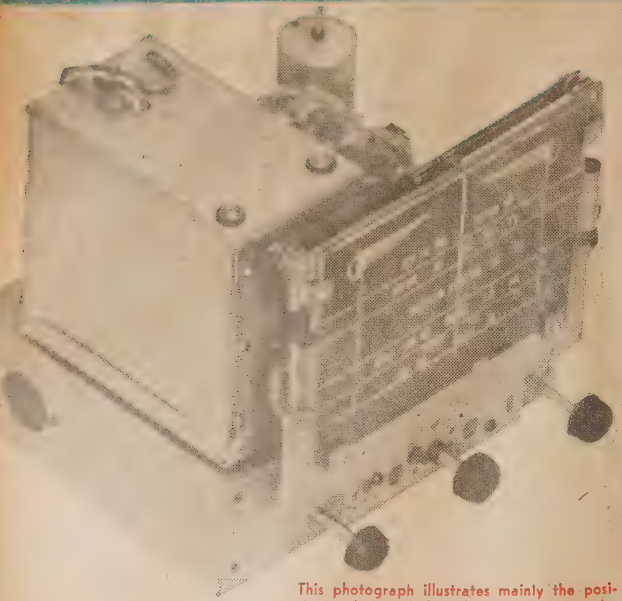
Figure 3 shows the circuit typical limiter stage abstracted f an American FM receiver design will be noted that a sharp cu valve is used, in this case a 6 although other high-slope valves commonly used. The only bias vided is that which can be gener across the grid return resistor bypass. The plate voltage is app through a 0.1 meg. resistor, w the screen voltage is also lower t usual.

(Continued on Page 57)



This curve illustrates graphically the action of a limiter stage. Note that it functio only on large input signals. Below: A typical two-stage limiter using resistanc coupling to avoid trouble with I.F. channel instability.





This photograph illustrates mainly the position and size of the vibrator power supply. The position of the other components is exactly as in the "All-Battery Five."

THE R & H “ECONOMY FIVE”

A few circuit changes and the addition of a vibrator power supply converts last month's "All-Battery Five" into the most economical Vibrator set we have yet described. With plenty of gain and selectivity for general use, it delivers a power output of 250 milliwatts and draws less than three-quarters of an amp from a 6-volt battery.

LL vibrator sets, which we have described to date for domestic e, have employed the standard volt series of valves, chiefly because ese valves are very reliable in eration and give good overall per- rmance.

A receiver using them can be ex- ected to draw total current of be- een 1.1 and 1.5 amps from a 6-volt cumulator, depending on the exact sign of the circuit and the effi- ency of the components. This is not any means a prohibitive figure, rticularly in cases where the accu- ulator can be charged readily from rm machinery or at the local gar- e.

There are instances, however, here economy of battery drain is of aramount importance, and it is to ter for listeners so placed that we ave developed this present design. e total current drain is a fraction der 0.7 amp, with a fresh accumu- tor, which is roughly half that of equivalent receiver using 2-volt lves. This means, in turn, that sits to the charging station will be necessary at much less frequent intervals.

As we have stated on previous occasions, the miniature valves cannot rival their larger counterparts, in terms of sheer reliability and long life. Economy seldom does go hand in hand with lengthy service. But, for all that, the 1.4 volt valves are gaining in popularity, and there is no reason why they should not be just as successful in a specialised domestic receiver as they are in a portable.

THE CIRCUIT

We simply present both aspects of the matter and leave it to yourself to decide whether the design attracts.

The electrical circuit is a logical development from the "Multi-Talkie" in the July issue, and the more recent "All-Battery Five." Like the "All-Battery Five," it has an R.F. stage to ensure good selectivity, good signal-to-noise ratio, and adequate gain. The differences in the circuit accrue largely from the series-parallel arrangement of the filaments, which has an intimate effect on the bias conditions for all valves.

At this stage it is perhaps as well to repeat the warning which applies to all circuits involving a series-filament arrangement. If the valves are to operate correctly, it is essential to duplicate the original design. The substitution of other valve types may completely upset the filament net work and bias conditions, and possibly cause valve burn-out. At the same time we could not possibly undertake to cover the modifications necessary to accommodate all kinds of odd valves, and our advice therefore is to follow the original circuit in detail—or not at all!

Checking through the circuit, it will be noted that the two sections of the 3V4 filament are operated in parallel, which pre-supposes a total current of 100 milliamps through the filament network. The 3V4 is at the positive end of the network, the valve next to it being the 1S5. This filament is shunted by a 30-ohm resistor, which carries 50 milliamps at 1.5 volts, and leaves the remaining 50 milliamps to flow through the 1S5 filament.

Next in line come two 1T4 filaments, connected in parallel and passing 100 milliamps between them.

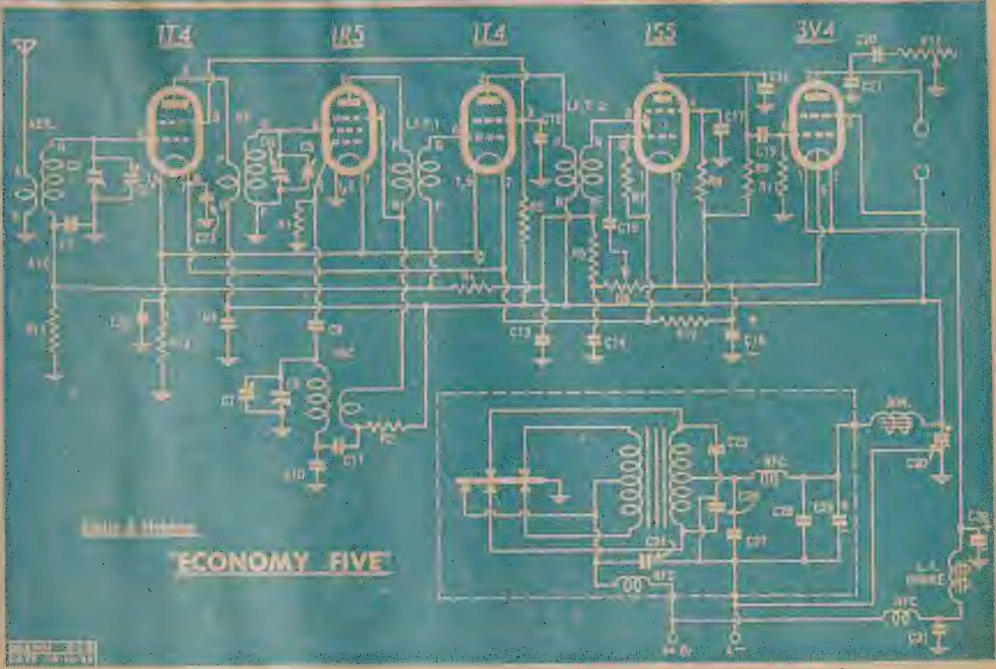
Finally, at the earthed end of the network, comes the 1R5 filament, duly shunted by a 30-ohm resistor to account for the additional 50 milliamps of current. The entire filament network therefore draws 100 milliamps, the individual voltages adding up conveniently to 6.0.

From the safety angle, the only two filaments which are interdependent are those of the 1T4 amplifiers. If one of these should become open-circuited, or the set be switched on with one of the valves out of position, the remaining filament would be overloaded, and eventually suffer damage. Care is therefore necessary to see that these valves in particular, are both in place before the set is switched on. Should it fail in service, switch off immediately and check the two filaments to make sure that both are intact.

Failure of any of the other valves would either open the circuit completely or simply cause a greater proportion of current to flow through the corresponding shunt resistor.

These remarks, of course, apply in

IDEAL CIRCUIT FOR WEEK-ENDER OR CARAVAN



Here is the complete circuit diagram. The dotted line surrounding the vibrator supply indicates which components are contained inside the shield box. Note the RF and hum filtering in the filament circuit.

general to all vibrator receivers, and are merely repeated here as a warning to readers who may not understand the implications of a series filament network.

You will note that three bypass condensers are connected to the filament circuit, the electrolytic being a precaution against audio instability, while the two 0.1 mfd tubulars deal with possible R.F. feedback.

Checking the grid returns, it will be noted that the 3V4 grid resistor runs straight to earth, the valve acquiring an effective bias of 4.5 volts by virtue of the fact that its filament is that many volts positive with respect to chassis.

The 1S5 grid is returned through a large resistor to its own negative filament pin, the triode operating effectively with grid leak bias. The diode load, however, returns to the positive side of the filament, so that, allowing for a small current through the diode, the "take-off" point for the AVC line is a trifle more positive than the F-pin.

The AVC voltage is fed through a 2-meg. resistor to the 1T4 grid circuits, with another 2-meg. resistor to earth. A "voltage divider" effect is, therefore, present, which, in the absence of signal, puts the two 1T4 grid returns at the same potential as their "F" pins; this is just as it should be. Something less than the full AVC voltage is applied to the 1T4 grids, but it is, nevertheless, adequate. No AVC is applied to the 1R5 converter, both the grid and the filament returning to chassis.

PARTS LIST AND KEY TO CIRCUIT

PARTS LIST

1 Chassis, 8" x 6¼" x 2½" approx.
1 Vibrator Box, 5" x 4½" x 2⅞".
1 Vibrator Chasis, 4½" x 2½".
1 Vibrator Transformer 6V/90V, 20 mA.
1 30 H. 20 mA. filter choke.
1 Iron-cored L.T. filter choke.
1 H.T. R.F.C.
2 L.T. R.F.C.
1 6V. Synchronous vibrator.
1 Small 3-gang (400 pf approx.).
1 Dial type USL44, with BC glass to suit gang.
3 Broadcast coils (Aer, RF, Osc.).
2 455Kc IF transformers (No. 1 and No. 2).
5 Valve sockets, button base type.
1 Octal socket.
1 Permag speaker, preferably 6" type, 6K or similar.

VALVES:

2 1T4, 1 1R5, 1 1S5, 1 3V4.

CONDENSERS:

C1, .05 mfd tubular.
C2, C5, C7, gang trimmers.
C3, C6, C8, gang sections.
C4, C11, C12, 0.1 mfd tubular (200 V.).
C9, C13, C14, C16, .0001 mfd mica.
C10, .000425 mfd mica.
C15, C17, C19, .01 mfd mica.
C18, 25 mfd 40PV electrolytic.
C20, C25, C26, .02 mfd tubular.
C21, C27, C28, .001 mfd mica.
C22, C23, C24, C31 0.1 mfd tubular (200 v.).
C29, C30, 8 mfd 350-volt or higher, electrolytic.
C32, 500 mfd 12 PV electrolytic.

RESISTORS:

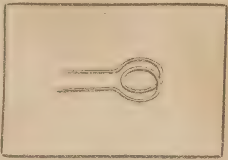
R1 .1 megohm.
R2 7,000 ohms.
R4 R14 1 megohm.
R3 .02 megohm.
R5 .05 megohm.
R6 1.0 megohm pot. with switch.
R7 10 megohm.
R8 2 megohm.
R9 .5 megohm.
R10 30 ohms.
R11 3 megohm.
R12 .05 megohm pot.
R13 30 ohms.

SUNDRIES:

2 terminals, one red and one black, approx. 12" shielded wire, 1 octal plug, hook-up wire for battery and speaker leads, three knobs, solder lugs, nuts and bolts, rubber grommets, &c.

★ R.C.S. RADIO

F.M.



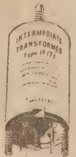
COILS

FOR R. & H. F.M. TUNER

These coils are machine wound from No. 12 gauge copper wire heavily silver plated, and are accurately spaced to cover the F.M. band 88-110 M/C.

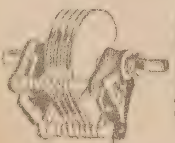
Aerial Coupling Coil	Type E362	2/6 ea.
Aerial Coil	Type E363	2/6 ea.
Oscillator Coil	Type E364	2/6 ea.

F.M. 10.7 MEG. INTERMEDIATE TRANSFORMER



Type No. IF180 Price 13/- ea.
Wound on Polystyrene Formers, moisture proofed with high frequency lacquer. Can size 1⅜" dia x 2½" High. 50 mmf silver mica condenser moulded in base necessary at these high frequencies.

MIDGET VARIABLE CONDENSERS



M.C. Type with Face and Back Supports

Type	mmfd.	Plates	Price
CV41	10	2	7 3
CV42	15	3	7 9
CV43	25	4	8 4
CV44	35	5	9 0
CV45	50	7	9 6
CV46	70	9	10 0
CV47	100	14	11 3

F.M. DISCRIMINATOR TRANSFORMER RADIO DETECTOR

Type No. IF181. Price .. 17/6 ea.
Freq 10.7 megs. Cap. 50 mmf. Wound on Polystyrene Formers, moisture proofed with High Frequency Lacquer. Can size 1⅜" dia. x 2½" High. 50 mmf silver mica Condenser moulded in base necessary at these high frequencies.

NEW STANDARD INTERMEDIATES

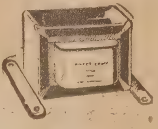
455 K.C. I.F.'s—with shunt silver mica Condenser Moulded in Base.
IF170—1st IF171—2nd, 13/- ea. IF174 Low Gain, 13/- each.

NEW PERMEABILITY TUNED COILS

1. Wound on Polystyrene formers.
2. Engraved with number and letters for easy identification.
3. 7/41 2 pie litz High Q Secondary.
4. Extra High Impedance Primary.
5. Fitted in round shield 2" high x 1⅜" dia. with 2 mounting feet, ⅛" Whitworth thread.
6. The can being printed with all technical specifications, etc.
7. Polystyrene sealed coils.
8. Special sealing channel for iron core screw.
9. Cores adjustable from top of chassis.

E356 Aerial
E357 R.F.
E358 Osc.
7/6 each retail.

VIBRATOR CHOKES



TC58 Low Tension 3 Amps 50 M/H .5 ohm D.C. Res. ..	15 0
TC70 High Tension 50 Henries 450 ohm D.C. Res 75 M/A	15 0

FILTER CHOKES

TC60 100 M/A 30 Henries 250 ohms D.C. Res.	13 6
TC65 50 M/A 30 Henries 400 ohms D.C. Res.	13 6
TC79 125 M/A 30 Henries ..	13 6

RADIO FREQUENCY CHOKES

RF81 Silk Honeycomb R.F. ..	1 9
RF82 3 pie 1.7 M/H R.F.	4 6
RF83 4 pie 2.5 M/H R.F.	4 6
RF84 5 pie 4.0 M/H R.F.	4 6
R.F. 85 6 pie 7.0 M/H R.F.	4 6
RF86 Cotton Honeycomb R.F.	1 6
RF106 Vibrator Low Tension R.F.	4 3

IF YOUR LOCAL DEALER CANNOT SUPPLY

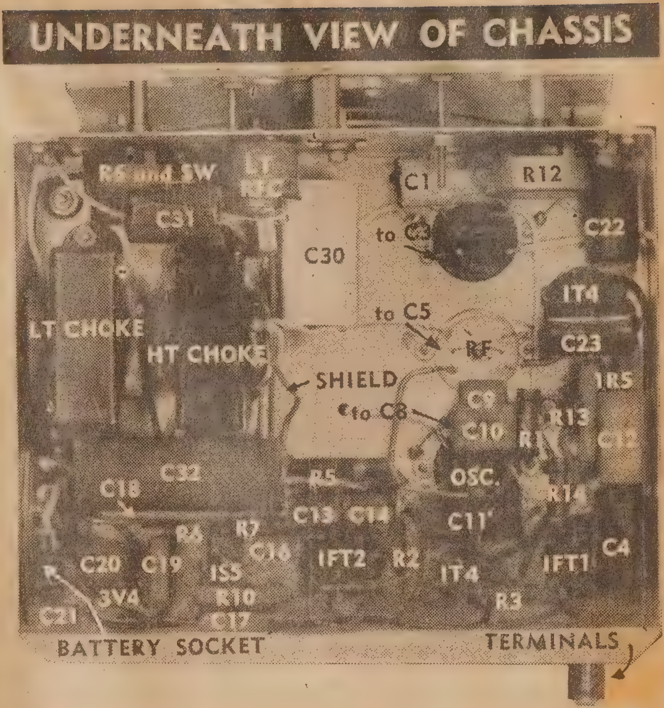
If you have been unable to purchase R.C.S. components from your local retailer, write us, and whilst we cannot supply you direct, we will arrange for your retailer to receive supplies immediately or advise you where supplies can be obtained.

R.C.S.
RADIO PTY. LTD.

R.C.S. RADIO PTY. LTD., 174 CANTERBURY ROAD, CANTERBURY, N.S.W.

For the rest, the circuit follows along fairly conventional lines and scarcely requires detailed comment. It will be noted that the screens of the 1T4 valves are operated at less than the full high tension voltage, to conform with manufacturers' ratings.

The vibrator power unit and its associated filtering follows closely along lines which have proved reliable in our "Vibra—" series of receivers. One can never guarantee that any given vibrator supply will be free from hash, but at least the chances of trouble will be minimised if the original design is followed carefully.



This coded photograph shows the position of most of the components beneath the chassis. Keep the 6-volt leads and filter circuit as far as possible from the RF section of the receiver.

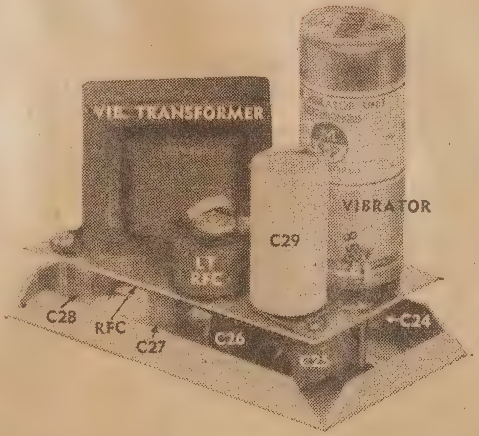
INNER PLATE

The vibrator transformer, socket, and associated chokes and condensers are mounted on a flat metal plate, which, in the original set, measured 2½in. x 4½in. It is desirable to arrange matters so that, as far as possible, all earth returns are made to a single point, which should be close to the reed pin of the vibrator socket. A heavy lead from this point is taken away to the chassis, forming the A- and B- return.

The components on the flat plate provide all necessary RF filtering in the primary and the B-plus circuit, the effect being completed by mounting the unit inside a metal box. More of this in a moment. The actual low frequency filtering is provided by iron-cored chokes located underneath the receiver chassis. The high tension filter requires a standard 20-50 milliamp choke and two 8 mfd electrolytics. The filament circuit requires a low resistance RF choke, a low resistance iron-cored choke and a 500 mfd, 12 PV electrolytic.

Physically, the receiver is constructed on the same chassis as the "All-Battery Five." In fact, we simply lifted out the original filament wiring, modified the circuit in a few essential details and added the vibrator supply. The original chassis measured 8in. x 6½in. by 2½in, but we will probably advise manufacturers to make the chassis ½in. longer to provide a trifle more clearance for the vibrator unit.

The vibrator unit was designed to occupy the vacant space in front of the audio valves and, as will be seen from the photograph, it fits in quite neatly. The box is 4½in. high, 5in. long and 2 7-8in. wide.



And here is the power supply assembly, treated in like fashion. One or two components are not actually visible in the top view.

The complete receiver forms a compact tube, small enough to fit into almost any of the available table model cabinets. It would be ideal also for building into a caravan.

Due to the small overall dimensions of the chassis, the placement of the vibrator unit is fairly important, and, in some positions, there was a teddency for the fields surrounding the transformer, chokes, &c., to couple into the input circuit. The ultimate mounting arrangement is rather novel, but a perfectly legitimate one.

The shield box is mounted on the chassis with the open end upwards, the vibrator assembly hanging vertically downwards from the push-on lid. The box should preferably be mounted with grommets or washers in such a way that it can be earthed to the chassis at one point only.

The plate carrying the vibrator components should similarly be insulated initially from the lid, being earthed to it at one point only by a single heavy lead. Alternatively, you may find it preferable to insulate the plate completely from the lid, running the earth wire, together with the other leads, down to an earth point beneath the chassis.

FREE FROM "HASH"

By adopting such measures we found it possible to make the receiver completely free from hash trouble and individual constructors should not have any special difficulty in doing likewise. If the vibrator supply, on the other hand, is separated from the chassis by a few inches, you will find that its placement is not at all critical and, in fact, it did not appear to be very important whether certain of the filter components were in circuit or not. In this matter we have followed conventional practice, on the assumption that all preventive measures may be necessary in certain cases. Such are the vagaries of vibrator power supplies.

Brand New Liquid Filled R.A.A.F. Compasses

Suit Boats, Aircraft or Country Man. Price £4/15/-

A.T.C. Cadets, Dalton Navigational Computors 22/6

Genuine RAAF Headphones and Throat Mike Sets 22/6

Oilskin Coats and Trousers to match. Suit yachtsmen, etc. 15/- the two.

Go Fishing and Feel Safe. Inflatable Life Preservers. New RAAF Type 17/6

American Jungle Hammocks, complete with Mosquito Net and Waterproof Canopy. With zipper, 45/-; without zipper, 35/-.

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Eyeglasses 6/6

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Tweezers (English) .. 3/6 and 5/6

Emergency Lifeboat Transmitters

and DI-Pole Aerials. Brand new. Complete. Price 12/6

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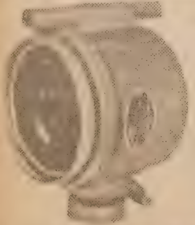
Will pump up to 180lbs. Price. £4/10/-

American Delco 24-Volt Motor

AC or DC. Brand New. Price £2/2/-.

Speed Control Rheostat and Switch Combined. Can be used with above motor. Price 7/6



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Suitable for Shooting or for use on Trucks, Cars, etc.

Price, 17/6

R. A. A. F. Engine Driven Pumps will Pump 200 gals. per hour.

Brand New. Price 25/-

Super Bargain List Super Bargain List Read! Read! Read!

10" American Dividers	6/6 pair
12" Carpenters' Dividers,	5/6 pair
½" Drive Universal Joint	10/6
4" Firm Joint Inside or Outside Calipers	2/3 each
American Spark Plug Socket, ⅞" size	8/6
English Bolt End Cutters,	7/6 pair
Car Trouble Lights	3/6 ea.
500 Micro Amp. Meters	25/-
Caravan Roof Lights	9/6 ea.
Biycle Locks	3/6
Hand Vices	4/- ea.
Disston Hacksaws, New	5/6
6" Carpenters' Dividers	3/6
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Starret Radius and Fillet Gauges	9/6
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American Super Clear Perspex

18" x 12"	17/6 sheet
26" x 13"	22/6 sheet
18" x 10"	17/6 sheet
13" x 11"	10/- sheet

Perspex can be curved by first immersing in hot water.

24 volt D.C. A.C. Motor and 400 GPH Pump combined £5/5/-

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Push Button Tabulator, will tabulate to 1000 .. .. 17/6

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Ideal for Battery Charging or Model Train enthusiasts. Price .. 7/6

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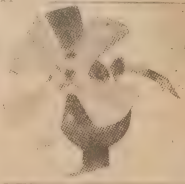
Ideal Home Lighting System, Power Plant. Work off any farm Engine. Price £10/10/-

Also 24 Volt Rating £12/10/-

American 24-Volt "Agastat" Time Delay Relay

with variable time delay control. Price 17/6



RAAF 24-volt DC, AC Electric Motor and Fan, suitable for use on caravans, and use with home lighting plants. Price 37/6

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Mail Orders carefully packed and efficiently despatched. Please add freight or postage.

R.A.A.F. Aircraft Instruments

American Altimeters (illustrated), with Milli-Bar Scale, £3/10/-.

Aircraft Flap Indicators. Contain 4 meter Movements, 22/6.

Altimeter Replacement Movements.

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Turn and Bank Indicators. Spirit Level Type, 30/-. Hand Indicator Type, 15/-.

Engine Speed Indicators. 2800 rpm. Twin Indicator Type £3

Manifold Pressure Gauges, new, 12/6 each.

Engine Rev. Counters, £2. Generator to suit same, 15/-.

Engine Temperature Gauges, 0-350 deg. c. 25/-

4000 rpm Rev. Counter, with flexible drive to suit 50/-

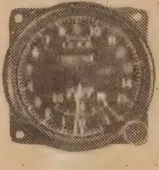
Radiator Temp. Gauge. Complete with Thermostat, 140 deg. c. .. 37/6

Sperry Directional Gyro £3

Radio Altimeter Indicator, 1½ Milliamp Meter Movement 25/-

Airspeed Indicator, with Pitot, 17/6

Engine Temp. Gauge, 3" dial, 350 deg. c. £2



English Altimeters (illustrated) 30/-

Air Temperature Gauges, 3" Dial. —30 deg. c. to +50 deg. c., 25/-

Sperry Artificial Horizons 50/-

Solid Leather Medicine Balls

Brand New. Worth 25/-. Price only 8/6

5-valve Battery Receiver

Ideal for Caravans and Boats.

Absolutely Complete. Usually cost £28. Price £16/10/-

Brand New Army Telephones

Simple to install and operate. Work exactly the same as PMG phones from house to house, house to shed, etc. Price £3/19/6

A few only slightly used, but Tested and in Working Order Don V. Telephones. Price £2/16/-

RED CROSS FIRST AID KITS

Consisting of Metal Carrying Box and Khaki Satchel. Containing 30 items including: Adhesive Tape, Burn Salve, 8 Bandages, Eyebath, 7" English Sheffield Scissors, Cotton Wool, Iodine, Gauze, Saf. Pins. Invaluable in the home, workshop or caravan, etc. Worth double the money. Price 22/6

TWIN DOUBLET AERIAL FOR S/W LISTENERS

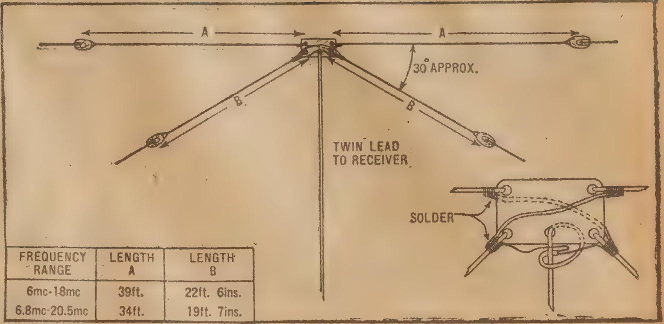
In response to many requests, we present this aerial system as one which will give better results than an inverted L over the band of frequencies normally used for short wave broadcasting. It has the added advantage of reducing man-made interference.

TWO sets of dimensions are given to suit the band coverage of ordinary dual wave receivers. Beyond the limits stated, the response curve of the aerial system begins to fall off.

The aerial may be constructed of any suitable copper wire, insulated or otherwise. The measurements shown are from the centre of the insulator to the hole in the piece of insulating material in the centre of the aerial.

This piece of insulating material may be of bakelite, wood boiled in paraffin or any piece of insulation which is sufficiently robust to carry the strain of the wires. A suitable alternative is to wire together four egg-type insulators. The angle between lengths A and lengths B is shown as 30 degrees but this figure is not critical.

The aerial wires should be erected as high as possible and pointing end-on to any known source of electrical interference—if such is being experienced.



FREQUENCY RANGE	LENGTH A	LENGTH B
6mc-18mc	39ft.	22ft. 6ins.
6.8mc-20.5mc	34ft.	19ft. 7ins.

The type of feed line from the aerial centre to the receiver input is open to variation. Rubber-covered power flex may be used or the plastic-covered flat type. It should be arranged so that it drops vertically from the centre of the aerial until it is well clear of the wires, before being taken to the receiver. It may not be possible to provide for this in all cases, but do the best you can.

The connection to the receiver calls for a special arrangement. The primary winding of the aerial coil should ideally have both ends free with a centre-tap connected to earth. An electrostatic shield can be placed to advantage between this primary winding and the secondary or grid winding.

Naturally, this would be difficult to arrange in conventional dual-wave receivers. We therefore suggest that, failing any changes in the receiver input coil, you connect the respective leads to the aerial and earth terminals of the set. This will upset the noise-reducing properties of the system but will not materially affect the pick-up response.

Some constructors or listeners may be in a position to lift the earth side of the primary winding from the chassis and connect this side to one of the incoming leads of the twin cable. Quite obviously, you will not be able to earth the centre of this winding, but this is of lesser importance.

"The YORK"

4 VALVE BROADCAST MANTEL

KIT SET

"The York" features:

Attractive Bakelite Cabinet (as illustrated); size 10¾" x 6¾" x 6½". Also available in cream.

Rola 5 inch speaker.
R.C.S. Intermediates

Valves, 6J8G, 6G8G, 6V6GT, 6X5GT.

Full Vision Dial.

A proved circuit with full instructions, easy to follow.

Complete to the last nut and bolt, including valves.

Price £15/19/- retail

Attractive Discounts to the Trade.

Build your own Radio Set and save pounds.

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Also supplied as a Foundation Kit Set—a boon to the small manufacturer. Prices on Application.

Christmas

SUGGESTIONS FOR THE RADIO ENTHUSIAST!

Give yourself, your son, your dad, or that person of whom you think so much, a really worthwhile present this Christmas. Perhaps mum would like a radio set for herself, or your sweetie a portable. If so, now is the time to build one up from an Electronic Parts super quality kit-set. We offer you many worthwhile suggestions from our huge range of radio kits, amplifier kits, test equipment and test equipment kits.

OVER 40 DIFFERENT KIT-SETS

Yes, you're certain to find the kit you want here. All types are covered from the midget portable to the super gramo-combination. Satisfaction is certain because only best quality components are used, and the kits are made up by radio-trained men who are themselves enthusiastic set-builders.

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E.P. KITS

In the famous Electronic Parts plastic cabinet (below) and complete with valves, speaker, full building instructions, etc.

- 4 valve B/C A.C. Kit.
- 3 valve Triple Wave A.C. Kit.
- 4 valve B/C Vibrator Kit using the Ferguson Vibrator Unit.
- 4 valve B/C Battery Kit.

PORTABLES

What could be finer than a portable for the Christmas break—on the beach—driving—hiking? Or for a present? Think how the girl-friend would coo over one of these . . .

- Kingsley Walkie Talkie.
- Multi-Talkie.
- Handie Talkie.
- "University" PK4X.
- Springtime Portable.

They're winners all—and at bedrock prices!

IDEAL FOR THE BEGINNER

A one valve B/C—S/W Kit (below) the cheapest little set ever. Write now for details.

R. & H. KITS

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- MAJESTIC RADIOGRAM.
- 1947 SENIOR RADIOGRAM.
- LITTLE GENERAL '46.
- LITTLE GENERAL '47.
- 1947 ADVANCE.
- FIRESIDE 5 D/W.
- FIRESIDE 5 B/C.
- 1946 STANDARD.
- MINIVOX.
- ALL BAND T.R.F.
- VIBRAGRAM 7.
- VIBRA 5.
- VIBRA 4.
- TOM THUMB.
- PENTAGRID 5.
- PENTAGRID 4.
- ALL BATTERY 5.
- 6/240.
- SUPERHET TUNER.
- INTERCOM SYSTEM.
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- 4/48 MANTEL.
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- KFT1—5 valve B/C A.C. Superhet Kit.
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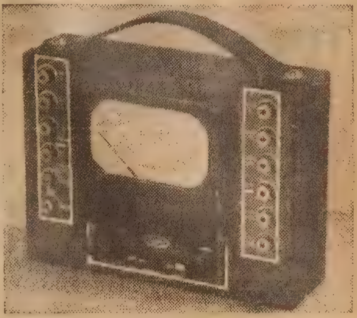
We can really recommend them too — the inexpensive kits like the MKI and OKI as well as the ready-built units (Supertester, Signal Generator, etc.) because we use only "University" gear ourselves and KNOW its good.

Send for our free technical leaflets and prices schedule. Give yourself a Christmas present that will still be paying dividends years ahead.



MK1 MULTIMETER KIT

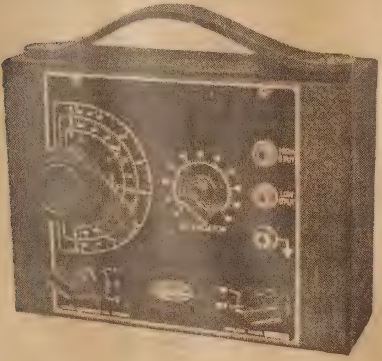
Fitted in the same steel case as the OKI (size 6" x 8" x 2½") this AC/DC multimeter kit is the ideal companion to it. Together they make an attractive and efficient pair for the serviceman and experimenter.

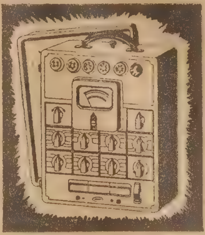
As with the OKI, no calibration is necessary, the set is easily assembled with a few simple tools, and full constructional details are included.

Using the popular 4" square meter with clear multiscale and covering extensive ranges, the finished instrument compares more than favorably with commercial multimeters.

OK1 OSCILLATOR KIT

A pre-calibrated 3 band oscillator kit guaranteed accurate to within plus or minus 2 per cent. Accuracy is assured because all of the critical wiring is done, and the set calibrated and thoroughly tested before being despatched to you. Thus, all you have to do is connect up a few leads, and this oscillator is ready for service calls or bench work. Full instructions on the construction and use of the OKI are supplied and the kit comes to you complete with batteries and all parts to the last nut and bolt.





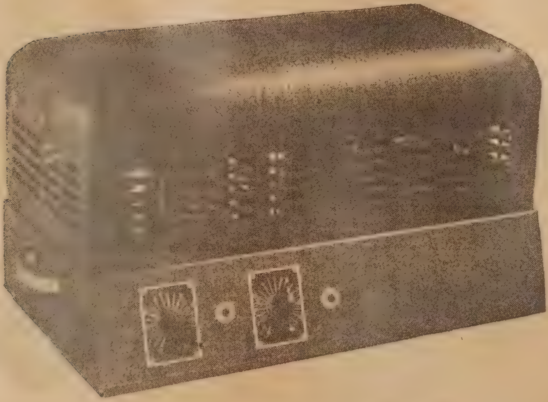
SUPERTESTER

The most modern and efficient valve and circuit tester on the market. This compact instrument combines all the functions of a multimeter, output meter, tube tester, paper and mica condenser tester, a really efficient electrolytic condenser, impedance and leakage tester —all in the one case. It is available in two models, for A.C. operation only, or for universal operation from A.C. or 6 volt battery. Write for full technical details of the Supertester.

. . . and all these other

"UNIVERSITY" INSTRUMENTS

- S.T.B. Signal Tracer.
- U.S.O. Universal Speaker & Output Meter.
- XOA (A.C.) Service Oscillator.
- XOB (Battery) Service Oscillator.
- V.R.M. (D.C.) Voltohm Meter.
- M.V.A. (AC/DC) Multimeter.
- S.G.A. (A.C.) Signal Generator.
- E.X.T. Earth Resistance Tester.
- A.S.T. Supertracer.



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Attention Sound Enthusiasts! Here are 8 different amplifiers to meet the needs of all interested in P.A. work and quality reproduction. Available as kits or completely built and supplied in best quality parts only, these amplifiers are exceptionally good value, both in price and performance.

Write today for details of:

- 45 Watt Super Power P.A. Amplifier.
- 20 Watt All purpose Fidelity Amplifier.
- 15 watt Ultra High Fidelity Amplifier.
- 12 Watt Vox Major Amplifier.
- 10 Watt General Purpose Amplifier.
- 4.5 Watt Vox Minor Amplifier.
- 13.5 Watt P.A. Vibrator Amplifier.
- 4 Watt Vibravox Amplifier.

Now is the Time to Prepare for CHRISTMAS

to decide which kit you want and start into building it. Things have a way of piling up, so start right away and make sure of your effort for the 25th.
Send for our leaflets and price lists today (marking which items interest you).
Remember, it's only 7 weeks to Christmas.

Merry Christmas!

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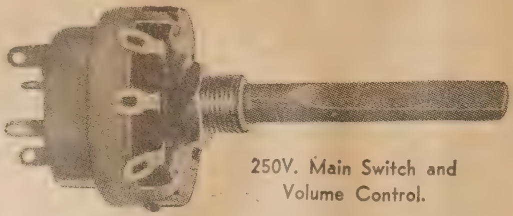
THE NEW AEROSTAT TYPE M

VOLUME AND TONE CONTROLS — with or without switch attached

SMOOTH



SILENT

250V. Main Switch and
Volume Control.

LONG TROUBLE-FREE LIFE

Mechanically and electrically, Type M is the quietest, smoothest and most trouble-free control. That is why so many of the leading brands of receivers use AEROSTAT Controls.

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Factory Representatives N.S.W. & Queensland

OTHER NEW FEATURES

- Terminals may be twisted or bent without loosening or breaking.
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- Switch approved for use as 250 volt Mains Switch (single or double pole).

AVAILABLE FROM ALL LEADING DISTRIBUTORS

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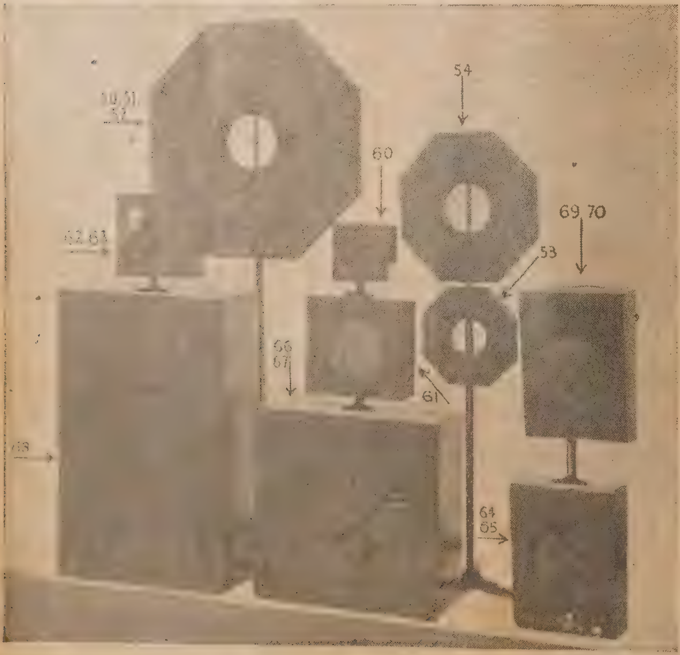


Item No.	Type	Speaker Size
50, 51, 52	H8, H10, H12	8", 10", 12"
53	J8	8 in.
54	J10	10 in.
60	A5	5 in.
61	A8	8 in.
62	B8	8 in.
63	C8	8 in.
64, 65	D8, D10	8 in., 10 in.
66, 67	F10, F12	10 in., 12 in.
68	G12	12 in.
69, 70	I8, I10	8 in., 10 in.

Manufactured by

STEANES SOUND SYSTEMS PTY. LTD.

60-80 Miller Street, Melbourne
FJ9140, FJ9149, FJ4543.

And at
367 Kent St., Sydney. MA2588, M3136.

Getting Started on F.M.

(Continued from Page 47)

Positive going pulses cause grid current to flow and produce a standing bias across the grid return resistor and bypass.

Individual pulses tend to be reproduced in the plate circuit by the natural action of an amplifier valve. However, the limited plate and screen voltage prevents the plate current from achieving a high peak value, the output wave tending, instead, to be flattened at the top. On the reverse half cycle, negative going pulses reduce the current from its already low figure to cut-off, which, of course, represents the limit in this direction. Thus, excursions of plate current, both up and down, are severely limited.

DISTORTION

In an AM receiver such a condition would lead to intolerable distortion; the varying amplitude of the signal contains the modulation, and the shape of the modulation envelope must be preserved at all costs. In the case of an FM signal, the significant feature is the frequency variation and the amplitude can be subject to severe limitation without danger of creating distortion.

It follows that the limiter stage of figure 3 will not exercise a complete limiting action on a weak input signal, since the variations in amplitude may lie completely or in part within the dynamic operation of the tube.

For the limiting action to be complete, it is essential for the input voltage to "swamp" the grid circuit completely, so that amplitude variations due to noise are not reproduced in the plate circuit, due either to the valve being operated past cut-off on the one hand and in the region of plate current saturation on the other.

VALVE CURVES

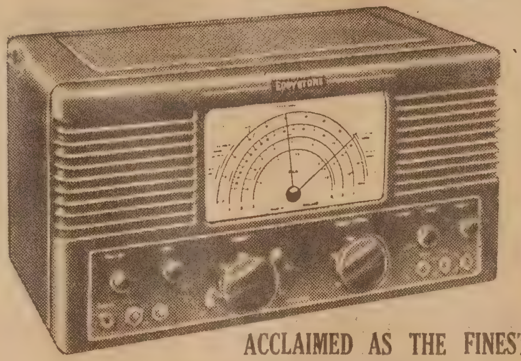
These points are illustrated graphically in figures 4A and 4B. Figure 4A shows how the plate current peaks are flattened when the grid signal voltage swings the valve beyond the ends of its dynamic operating curve. Figure 4B illustrates the action of the same valve with both strong and weak input signals carrying a certain amount of AM noise modulation. The figures make it obvious why high gain is required ahead of the limiter grid and why an FM receiver of this general type has a threshold below which AM noise can become a problem.

The time constant of the grid return resistor and bypass has an important bearing on the precise action of the limiter. A long time constant is desirable in the interests of supplying a well regulated signal to the diode discriminator, but, unfortunately, it does not function as effectively as it might in limiting noise due to auto ignition and static crashes.

On the other hand, a short time constant shows a much improved

(Continued on Page 89)

This is it!
the "640"



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EDDYSTONE AMATEUR BANDS
COMMUNICATIONS RECEIVER MODEL 640

MAIN TECHNICAL FEATURES

1. Receiver has been designed primarily for Amateur Communication purposes, tuning range from 31 Mc/s to 1.7 Mc/s.
2. Designed to operate from Standard AC Mains with Inputs of 110 volts 200/240 volts, 40/60 cycles as well as from a 6 volt battery by the use of a separate vibrator unit.
3. Inclusive all valves, the "640" is a 9-valve job with one tuned RF stage, FC, two IF stages, detector-AVC-1st audio, 2nd audio output, noise limiter, BFO and rectifier. The valves used, in that order, are EF39, 6K8, EF39, EF39, 6Q7, 6V6, EB34, EF39, and 6X5. These are all international octal based on the Mullard or Brimar versions and are therefore easily replaceable.
4. INPUT IMPEDANCE—400 ohms.
5. TUNING RANGE—
   (1) 31 to 12.5 Mc/s.
   (2) 12.5 to 5 Mc/s.
   (3) 5 to 1.7 Mc/s.
6. TUNING. An electrical band-spread arrangement is used for this purpose. Fly-wheel control is utilised on the band-spread condenser drive. The scale is clearly marked with all amateur bands, and is so arranged to enable accurate re-setting to a spot frequency.
7. I.F. FREQUENCY—1600 Kc/s.
8. CRYSTAL FILTER is vacuum mounted to provide a high degree of stability. Phasing control and "in/out" switch are brought out to the front panel.
9. Sensitivity is better than 2 microvolts input, for 50 milliwatts output, at all frequencies.
10. OUTPUT. Audio frequency output exceeds 3.5 watts.
11. "S" METER. A socket is provided for an external "S" Meter.

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FOR THE JUNIOR EXPERIMENTER

LET'S TALK ABOUT COMPONENTS — RESISTORS

Resistors, either fixed or variable, appear in almost every radio circuit that one can imagine. Since they are so universal in their application, it is essential for the beginner to know something of them—their construction, their appearance and what function they serve in the circuit. This article is the first of two on the subject.

RIGHT at the outset it is as well to introduce the schematic symbol for a resistor, a zig-zag line as in figure 1a.

An arrow through the resistor, as in 1b, indicates that the resistor is variable in value. An alternative method of indicating a simple variable resistor is shown in 1c, where one connection takes the form of an arrowhead tapping into one side of the resistance element.

Figure 1d, on the other hand, indicates that there is a connection to each end of the resistance element, as well as a tapping. The tapping may be fixed, or capable of adjustment, or freely variable — points which we will explain more fully elsewhere in the article.

The basic unit of resistance is the "ohm," and it is therefore conventional to express the value of a resistor as so many ohms.

WHAT IS AN OHM?

Electrically an ohm is that amount of resistance which will introduce a drop of one volt in a circuit when the current flowing through it is one ampere.

The very famous pioneer whose name significantly was Ohm expressed the above relationship as "Ohm's Law":

R equals E/I

where—

R is the resistance in ohms,

E is the voltage drop, and

I is the current through the circuit in amps.

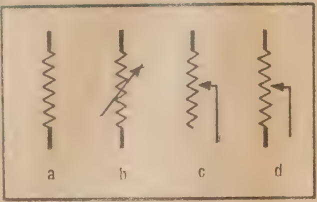
Our only excuse for introducing this mathematical formula is that it is so simple and yet so important. Take a scrap of paper and work out a few problems to impress its use on your mind. Then transpose the terms as below and repeat the process:

I equals E/R and E equals IxR.

Just for good measure you can practice substituting milliamps for amps, remembering that you have to multiply or divide the answer by 1000 to maintain the accuracy of the formula. But enough of that.

R.M.A. RESISTOR COLOR CODE Values in Ohms.

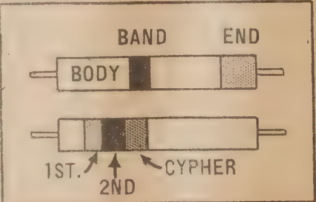
Body Color	First Digit	End Color	Second Digit	Dot Color	Remaining Digit
Black	0	Black	0	Black	-
Brown	1	Brown	1	Brown	0
Red	2	Red	2	Red	00
Orange	3	Orange	3	Orange	000
Yellow	4	Yellow	4	Yellow	0000
Green	5	Green	5	Green	00,000
Blue	6	Blue	6	Blue	000,000
Violet	7	Violet	7	Violet	0,000,000
Grey	8	Grey	8	Grey	00,000,000
White	9	White	9	White	000,000,000



Typical schematic circuit symbols for resistors, both variable and fixed.

As one might expect, there are plenty of occasions where the resistance value in a circuit runs into many thousands of ohms and we find the figures becoming rather cumbersome to express and to write.

Accordingly, one million ohms is, by common consent, referred to as one "megohm." Thus, instead of saying, or writing, 1,000,000 ohms we simply put it down as 1.0 megohm. Being lazy people, this is again contracted in everyday speech to "1 meg."



Depicting alternative methods of color coding resistors. The order of reading is explained in the text, while the accompanying table gives the significance of the various colors.

At this stage you may wonder at the term "point one meg," or such like, which appears in print as "0.1 meg." The answer is simple.

The decimal 0.1 simply means one tenth. Thus "0.1 meg" simply means one tenth of one million ohms, which is 100,000 ohms. It is obviously much easier to say "point one meg" than "one hundred thousand ohms."

In just the same way 0.5 meg is equal to 500,000 ohms, and 0.25 meg is equal to 250,000 ohms.

COMES EASILY

Taking the notation one step further, it is possible to express 10,000 ohms as .01 meg, 20,000 ohms as .02 meg, and so on.

These expressions may seem rather confusing at first meeting, but one soon becomes used to them and, after a while, it is no effort at all mentally to convert .035 meg to 35,000, and so on.

In a schematic circuit the value is usually marked alongside the resistor symbol. Alternatively, the resistor may be shown as "R1" or "R2," &c., the key to the value being given in an accompanying parts list.

A certain amount of confusion is likely to arise in reading a circuit, in that the draughtsman may not always specifically mark the resistor values as so many ohms or megohms. Thus a resistor may appear simply as "2.0" without a specific indication as to whether it is two ohms or two megohms.

A GENERAL GUIDE

One has to be fairly conversant with circuit practice to be quite sure about this ambiguity, but, as a general rule, resistance value in megohms is expressed only in figures between about .01 and 10.0. If you see grid, plate or screen resistors marked with values between these two limits it is fairly safe to assume that the reference is to megohms.

Occasionally low resistance values —less than 10 ohms—occur in radio circuits, but almost invariably in connection with filament, heater or metering circuits.

Where a resistance value is stated simply as 200, 5000 or 20,000 it is safe to assume that the designer means "ohms." A resistance of 200 megohms would be either an accident or a technical curiosity!

Precisely the same remarks—in reverse—apply to the markings on resistors themselves. Resistors come to hand marked simply 300 or 5000 or 1.0, and it is often left to the user to determine whether the resistance value is in ohms or megohms.

Once again, familiarity with the components themselves will banish doubt on this score, but, in the meantime, it is fairly safe to assume that any figure in excess of 10 refers to ohms and not to megohms. Values less than 10 will normally refer to megohms, except in the case of small, wire-wound resistors intended for use in filament, heater or metering circuits. The reference to "wire-wound" resistors will be explained in the next issue.

TABLE SHOWING POPULAR SIZES OF RESISTORS IN THE R.M.A. CODE

Resistance in Ohms	Body Color	End Color	Dot Color
2000	Red	Black	Red
5000	Green	Black	Red
10,000	Brown	Black	Orange
12,000	Brown	Red	Orange
15,000	Brown	Green	Orange
20,000	Red	Black	Orange
25,000	Red	Green	Orange
30,000	Orange	Black	Orange
35,000	Orange	Green	Orange
50,000	Green	Black	Orange
70,000	Violet	Black	Orange
75,000	Violet	Green	Orange
100,000	Brown	Black	Yellow
150,000	Brown	Green	Yellow
200,000	Red	Black	Yellow
250,000	Red	Green	Yellow
500,000	Green	Black	Yellow
750,000	Violet	Green	Yellow
1 megohm	Brown	Black	Green
1½ megohms	Brown	Green	Green
2 megohms	Red	Black	Green
5 megohms	Green	Black	Green
10 megohms	Brown	Black	Blue

Many resistor values are indicated, these days, by a color code, which shows their value directly in ohms. To explain the code we can do no better than repeat in brief some paragraphs from the February, 1947, issue.

Separate colors are used to represent the numerals 0-9, and the color combinations are used to express the resistance value directly in ohms. The colors have the following significance: Black 0, brown 1, red 2, orange 3, yellow 4, green 5, blue 6, violet 7, grey 8, white 9.

COLOR BANDS

The first figure in the resistance value is represented by the body color. Thus, if the main body of a resistor is red, it follows that the first figure in the resistance value must be "2."

The second figure in the resistance value is shown by the end color. The significance of the individual color remains unaltered, so that, if our previously mentioned red resistor has a green end, the first two significant figures would be "25."

(Continued on Page 83)

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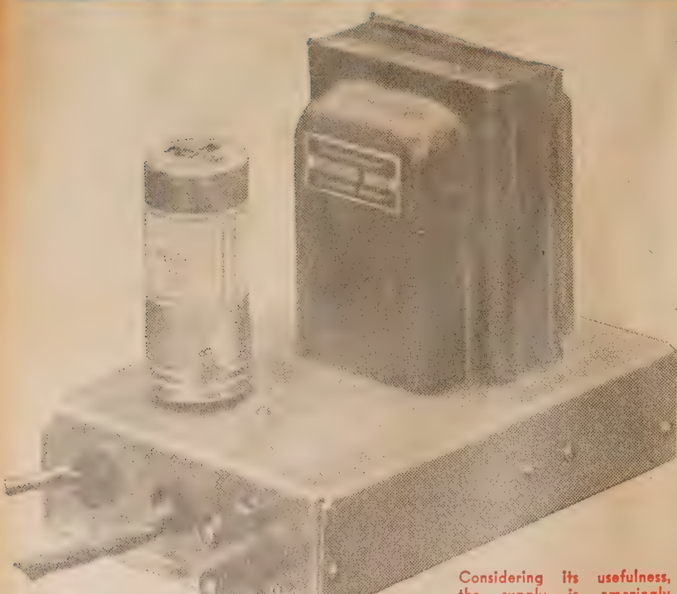


Considering its usefulness, the supply is amazingly simple. Note terminals for controlling the relay.

THE whole idea of a small auxiliary supply was a natural outcome of the 75-watt unit described in the last issue. If a single vibrator/transformer combination could deliver 300-odd volts at 70-80 milliamps, why not use it to operate an existing a-c amplifier?

The idea seemed so obvious and simple that we immediately set to work and built up a unit on a small chassis, connecting it for test purposes to the nine-watt amplifier described in the August issue. The scheme worked like a charm.

PUT TO THE TEST

At the psychological moment a member of our staff was asked to help with PA equipment at a secondary school sports oval. We duly passed over the whole box of tricks with the request "Give it a work-out." He did, and reported back really keen on the whole idea.

By way of interest, the amplifier and vibrator supply was simply placed on the front seat of a sedan car and the six-volt leads clipped to frame and to the wire coming up from the battery to the ammeter. The car was driven out into the centre of the oval and horn speakers perched on the roof.

Two pairs were then run out in front of the car, one to a crystal microphone and the other to control the relay. Each time an announcement was to be made the operator simply pressed the control button, said his piece and then released the button, switching off the HT circuit. The value of this feature will be apparent immediately to anyone who has had to operate battery equipment at open-air functions.

The steady drain on the battery is only the heater current which, in this case, amounted to 1½ amps. When the amplifier goes into operation, of course, the battery drain steps up to perhaps eight amps, but this drain is only imposed for short periods, with long rest periods in between. Any respectable car battery will operate this way all day without distress.

It is true that some commercial amplifiers have a "standby" switch on the chassis but, in practice, one cannot always arrange to be close enough to the equipment to operate it with the same ease as a "press-to-talk" button.

There is another point about such equipment which is not technical but is nevertheless important. When the microphone is open continuously the spectators in front of the speakers are treated to a variety of conversation pieces (sotto voce), coughs, train whistles, &c., not to mention the efforts of children to make sundry deliberate noises in front of the microphone.

With a "press-to-talk" button all these distractions are mercifully absent.

As we mentioned last month a modern synchronous vibrator cartridge will operate with an input to the primary contacts of about 30 watts. Allowing for 70 per cent efficiency in the transformer circuit, the secondary output watts will be 21, corresponding to, say, 300 volts at 70 milliamps.

For intermittent public address work an overload even beyond this figure is permissible, since the important factor is convenience rather than extreme reliability or length of vibrator life. It is a very simple matter to have a spare cartridge available, and the disadvantage of more frequent cartridge failure is not likely to be a very serious one.

Our latest vibrator supply was built up on a little aluminium chassis measuring 5in. x 6½in. x 1½in. The dimensions are not at all important, as it has to accommodate only the transformer, vibrator cartridge, a relay and a few odd small components. It is essentially one section of the larger supply featured last month, the transformer being designed to deliver about 325 volts d-c at 70-80 milliamps, assuming a synchronous vibrator.

POSITIVE AND NEGATIVE

The vibrator is wired in the conventional manner, the important point being to see that the windings are phased to deliver a positive output voltage with the primary polarity arranged as it will be when in service. Some vehicles have a positive earth return, others a negative return and it is just as well to arrange matters so that the power supply chassis is "earthy" with respect to the metal work of the vehicle.

The buffer condensers for the particular transformer employed are .03 mfd across each half of the winding and, lacking better types, we once again used 600 volt condensers of the appropriate value. Other transformers which you may employ in a similar type circuit may need a different value of buffer condenser. The 100-ohm resistors are not an essential item but their inclusion is considered good practice.

A .001 mfd mica and a 0.1 mfd tubular condenser bypasses each of the "hot" points in the circuit and there are RF chokes in the relay and B-plus leads as a precaution against hash trouble occurring in the microphone channel.

Actually no such trouble was encountered with the original unit, but vibrator supplies are such cantankerous things that you may need considerably more, or get by with considerably less, filtering than we have suggested.

6-VOLT LEAD

The A-battery lead enters the chassis through a rubber grommet and is fitted with suitably marked clips. We suggest that you use heavy three-core power flex for this lead, with two of the wires in parallel to minimise resistance.

The high tension and heater wires also come out the end of the chassis terminating in a suitable power plug.

The two terminals seen at the end of the chassis are for relay control.

PARTS LIST

- 1 Chassis 5" x 6½" x 1½".
- 1 Vibrator transformer 6V. input, 325v 70mA. output.
- 1 6-pin valve socket.
- 1 Relay (to operate on 6V.).
- 3 0.1 mfd. tubular condensers.
- 2 .03 mfd. (600V) tubular condensers.
- 3 .001 mfd. mica condensers.
- 1 L.T. R.F. choke.
- 1 H.T. RF. choke
- 2 100ohm resistors.
- 1 Vibrator (35ZH or similar).
- 2 terminals.
- 2 grommets.
- Hook up wire, nuts, bolts, etc.

The relay is of a type available from disposals stocks and should have a winding which will allow it to close positively on six volts. One relay contact is earthed, however, and it would be quite practical and convenient to use an auto-type cutout with the winding stripped down to operate on six volts.

Checking through the connections you will note that the voltage from the A-battery is applied direct to the heaters and also to the outer ends of the transformer primary. However, the vibrator does not immediately operate, since there is no exciting voltage applied to the driving coil.

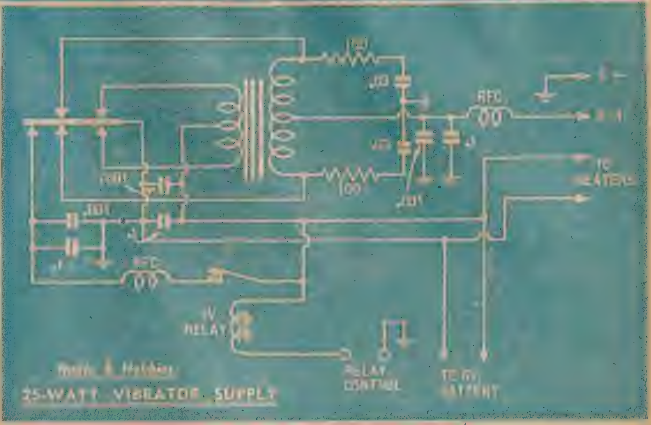
Immediately the circuit between the control terminals is closed, current flows through the relay winding, closes the contact and sets the vibrator reed in operation. Obviously, the vibrator cartridge needs to be a type having a separate driving coil and contact.

The d-c output from the vibrator circuit is filtered for RF only and still needs to be filtered for low frequency hum. Your a-c amplifier will already include a hum filter, and this can be employed by feeding the B-plus from the vibrator unit into a point ahead of one or both of the filter chokes.

In the case of the nine-watt amplifier mentioned earlier there are two filter chokes and three condensers, and the d-c can be applied in effect to the input of the filter, which is common to the rectifier filament pin. If the second choke is of good quality the output can be fed to the junction of the two chokes, thus avoiding the loss of voltage which occurs in feeding the supply through both units.

It is not reasonable, of course, to expect to excite a loudspeaker field if such is included in the filter circuit of an amplifier. The high d-c resistance of a field coil would cause a severe loss of voltage and compromise the whole success of the scheme. An amplifier having a field and choke for a-c filtering could be rearranged so that the field came first in the filter circuit and immediately after the rectifier. This would allow the vibrator output to be fed through the choke only. On the other hand, you may prefer, in such a case, to provide the vibrator supply with its own LF choke and electrolytics, applying the filtered output voltage direct to the high tension line.

SCHEMATIC CIRCUIT DIAGRAM



There is very little to the circuit. Tubular 600-volt buffer condensers will generally be okay, but mica types or a series-parallel combination of condensers will guard against breakdown.

A permagnetic loudspeaker is essential in any case to avoid need for field excitation.

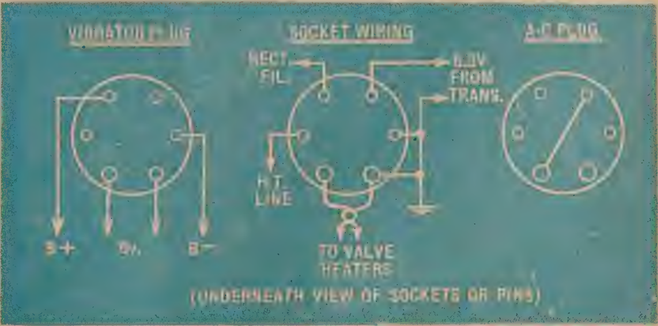
PERMAG. LOUDSPEAKER

The heater circuit needs attention, too, as the six volts d-c would otherwise be short-circuited through the heater winding of the a-c power transformer. The method of treatment given our nine-watt amplifier is worthy of mention.

This amplifier is provided with an auxiliary power output outlet socket, which is wired as shown. The valve heaters are connected to the thick pins of a six-pin socket, with one side of the heater wiring earthed. Note that all heaters must be wired in parallel and earthed by one side of the circuit only.

Other points on the socket connect to the HT line, the rectifier filament

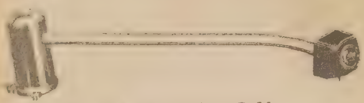
(Continued on Page 89)



For convenience, a power socket should be fitted to the amplifier, wired as shown. Heaters are automatically disconnected from the 6.3 volt transformer winding.

MAXWELL'S RADIO

Another First: "Goldring Products"



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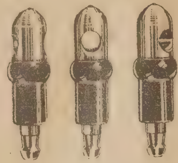

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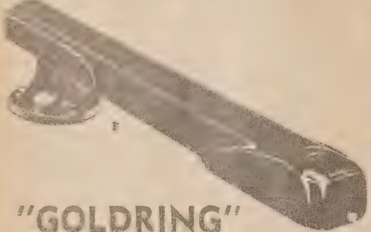

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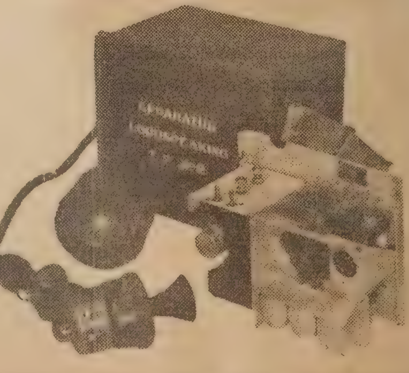

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FROM THE SERVICEMAN WHO TELLS

Every so now and again one gets a run of faults, which are so similar in character, that you begin to suspect that fate is playing whimsical tricks with your affairs. Last month I had a series of service calls involving instability in one form or another.

THE first instance concerned an ordinary four valve mantel receiver which was reputed to whistle on stations at odd intervals and for no apparent reason. Sometimes it was okay, sometimes not.

When I called to inspect the set, I tuned across the band and there was a definite "swish" on each carrier, although the set was not actually unstable.

Expecting to find a bypass condenser adrift I removed the chassis from the cabinet and turned it up for a "look see." Everything seemed in order. I therefore plugged it in again and this time was greeted by a definite whistle of oscillation. Tut, tut!

Where a set has been operating satisfactorily for some months it should not be necessary to add new components. It is more reasonable to assume that one of the existing components has altered in characteristic—probably a condenser in this case.

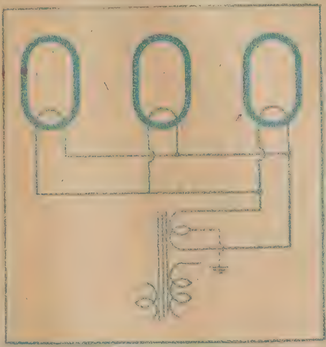
I prodded and poked and then tried bridging a 0.5 mfd. condenser between chassis and the various screen, cathode and AVC points. Lastly, I tried it on the B-plus line. This improved matters considerably, but the original condenser was definitely not faulty. At the same time the whole chassis appeared to be "touchy," the oscillation being less evident when I touched any of the metal work.

HEATER CIRCUIT

The set was actually operating by way of a bayonet adaptor plugged into a pilot lamp socket—not strictly to the book of rules, but plenty of people do it. Acting on an impulse, I reversed the plug and the set was immediately more stable. Here at least was a partial explanation for its queer behavior. But the plain fact of the matter is that it should not be necessary to plug a set in a certain way, or to hold your hand on it at all times, or to do any of the other strange things that seemed to affect this particular job.

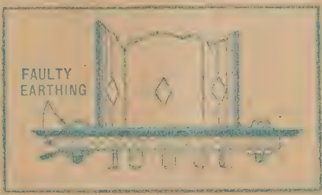
At this stage I acted on another impulse and flicked a piece of wire between chassis and each of the heater pins. Neither of the connections produced a spark, indicating that there was apparently no return of the heater circuit to chassis. Close inspection revealed that the intended link between chassis and one heater pin had come adrift by reason of a dry joint. The wire had originally been soldered to a protrusion on the chassis but it had rusted away, apparently due to excessive flux being used. Restoring the earth bond to the heater circuit cleared up the trouble completely.

The particular set had only a single 6.3 volt winding to supply all heaters, so that the failure of the earth bond provided a floating capacitive link between all heaters.



Heater circuits should always be returned to earth in some way—by the centre tap or one side of the winding or, in special cases, through a bias resistor and bypass condenser.

If the receiver had included an audio voltage amplifier, the missing heater link would have produced a noticeable buzz in the output and I would have diagnosed the trouble much more quickly. As it was, the audio gain was insufficient to produce hum in the output.



A bolt through the chassis does not always "earth" a solder lug or valve can. Paint, resin and aluminium oxide are all insulators.

The second case concerned a five-valve console receiver which was likewise unstable at odd intervals. It would play normally when tuned to a strong local station, but oscillated badly when tuning from one station to the next.

I went through the whole laborious process already outlined for the first set, except that one of the first things I checked was the heater circuit. As I might have expected, the earth return was okay. To cut a long story short, after checking the whole circuit, trying additional condensers, and so on, I made the startling discovery that the oscillation could be stopped by simply flicking a screwdriver on to the B-plus wiring. It could be started again by pressing the lower edges of the chassis inwards. After going through this procedure half a dozen times I began to doubt my own sanity. Oscillation just doesn't start and stop that way in any textbook I have ever read.

I checked and rechecked the bypass condensers, the AVC line, the grid resistors and everything else I could think of, and then more or less weakly bridged the suppressor pin of the IF amplifier valve to earth. Immediately the oscillation stopped, and no amount of pushing on the chassis would bring it back again. Yet there it was, a short length of busbar across to the cathode pin and thence to a solder lug under a socket-mounting screw.

NOT EARTHING

I have seen it happen three or four times before, but I still cannot believe it. A solder lug bolted tightly to a chassis, with spring washer and all, and yet not making good metallic contact! All I had to do in this case was to bond the cathode wiring to earth, and the set behaved normally. I might explain in passing that the receiver used back bias on the AVC line and that the screen bypass was returned to the same indefinite earth point.

As if that wasn't enough, these two jobs were followed up by a third one in which oscillation was the result of a valve shield on the IF amplifier which was not earthing properly.

If never before I understand why, as a very young wirer, I was taught that earth points in a chassis should always be bonded together with busbar as the very first wiring operation. If one of them happens to be doubtful, then the others will prevent trouble. For the very same reason, major set manufacturers go to a lot of trouble to return earth circuits to blobs of solder adhering very positively to a plated chassis.

SOME CORRESPONDENCE

A couple of months back we published a letter from a Victorian reader who, for personal reasons, preferred to remain anonymous. A second letter from the same reader

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„ 6	8" x 5" x 2½" with ends	7/2
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contains a couple of items which are of general interest.

He says: "I have come across two cases recently of short circuits in IF transformers of a well-known brand. In the first case, the receiver had a 'devilish' motor boat with a garbled signal in between the pops. I tipped it up to have a look at the AVC line, and the contacts on the 0.5 meg. volume control nearly belted my fingers off. The cause, which was located with the aid of a multimeter, was a short circuit where leads from the upper coil of the IF transformer crossed the lower coil.

"In the second case, the receiver simply stopped dead and the short was traced to a similar failure in a first IF transformer. The cure in both cases was simply to melt the lead out of the wax coating, slip a piece of sleeving over it, and seal it back into position.

"Surely the manufacturers could sleeve these wires, as, after all, there is a potential difference of up to 400 volts peak, and the only insulation in some cases is the meagre layer of enamel and cotton fibre covering the litz wire."

CORRODED WIRE

If I may interpose my own observations at this juncture, I cannot recall much trouble from short circuits in IF transformers, but I must confess that, more than once, I have looked at the wires which this reader mentions, and wondered why the insulation did not break down more frequently.

My most recent experience with a faulty IF transformer—I don't think it was mentioned before—was with a winding which became open-circuited in a relatively new receiver. Apparently a spot of foreign matter had found its way into the "honeycomb" and eaten through the fine litz wire. The receiver had been giving trouble for about six weeks prior to the ultimate failure, the effect being fading and crackling noises.

Carrying on with the letter, the same correspondent mentions a receiver which at times developed a heavy roar:—

POWER TRANSFORMER

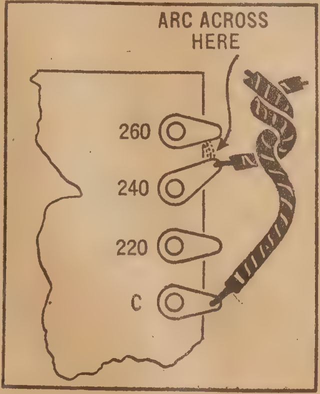
"I took it out to have a look at things, but found nothing wrong. However, subsequent pushing and prodding disclosed the cause, and it is fortunate that the resulting roar made it so essential to switch off the receiver that no harm was done.

"The receiver was fitted with a power transformer having a terminal plate for the mains connection, and the 240 volt lug was very loose. At times it would swivel round on its rivet, due to movement of the power cord, and strike an arc with the adjacent 260 volt lug."

Yes, loose power main connections are a classic cause of heavy interference in a receiver. Old-style fittings on the power outlet or loose mains voltage adjustments in the receiver create noise like nobody's business.

By way of conclusion I quote another letter which was brought to notice by the Technical Editor. A reader from Queensland, Mr. R. Pares, wrote originally to the R. and H. Query Service requesting comment on a home-constructed receiver which would not operate on the full high tension voltage. With only 45 volts of high tension, the set behaved normally except, of course, that power output was restricted. When 67½ volts or more was applied, the signals became weaker, and the set would not work at all on 135 volts. Normal hints about faulty valves, grid current effects, improper screen resistors, produced no solution, and it was left to Mr. Pares to locate the trouble himself.

He says: "I discovered a corroded conductor in the leads to the A-battery. When I rectified this, the trouble disappeared altogether, and, in fact, I had to increase the screen feed resistor of the IF tubes to prevent instability.'

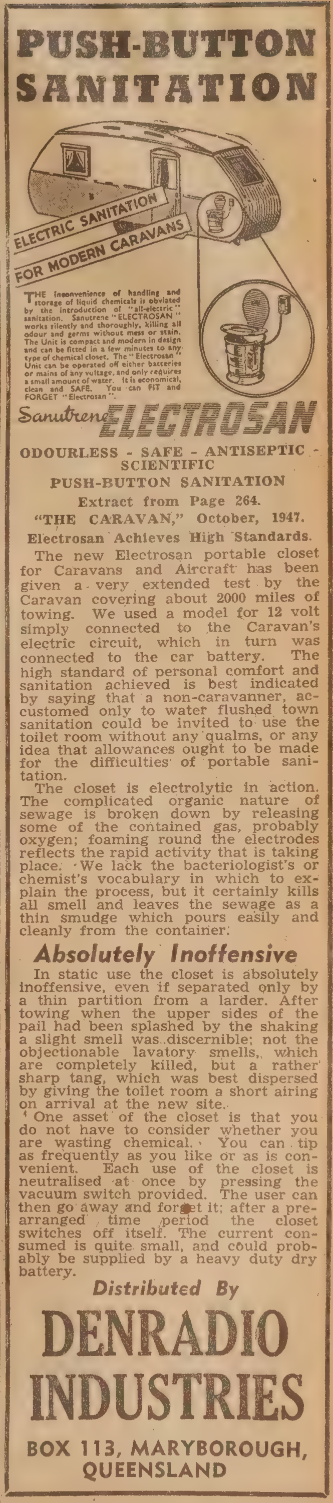


Loose connections or arcs in the 240V. main leads will produce a colossal noise in a receiver.

I am afraid that I cannot put forward a simple explanation for the effects observed by this correspondent; but, after all, "the proof of the pudding . . . &c."

While the exact experience may be rare, I suggest it would be a very good thing if all country readers went around to the back of the domestic receiver and checked over the connections to the accumulator. A few months' exposure to acid fumes does serious things to even the best connections, and it does not take much resistance at a half amp. drain to introduce troublesome voltage drop in the low tension circuit.

If there is any doubt, buy a new pair of "dog" clips and get out your pliers, screwdriver and soldering kit. Of course, if you cannot be bothered attending to these matters, one of my colleagues in your district will be quite happy to come and fix it up for you!



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PUSH-BUTTON SANITATION

Extract from Page 264.
"THE CARAVAN," October, 1947.
Electrosan Achieves High Standards.

The new Electrosan portable closet for Caravans and Aircraft has been given a very extended test by the Caravan covering about 2000 miles of towing. We used a model for 12 volt simply connected to the Caravan's electric circuit, which in turn was connected to the car battery. The high standard of personal comfort and sanitation achieved is best indicated by saying that a non-caravanner, accustomed only to water flushed town sanitation could be invited to use the toilet room without any qualms, or any idea that allowances ought to be made for the difficulties of portable sanitation.

The closet is electrolytic in action. The complicated organic nature of sewage is broken down by releasing some of the contained gas, probably oxygen; foaming round the electrodes reflects the rapid activity that is taking place. We lack the bacteriologist's or chemist's vocabulary in which to explain the process, but it certainly kills all smell and leaves the sewage as a thin smudge which pours easily and cleanly from the container.

Absolutely Inoffensive

In static use the closet is absolutely inoffensive, even if separated only by a thin partition from a larder. After towing when the upper sides of the pail had been splashed by the shaking a slight smell was discernible; not the objectionable lavatory smells, which are completely killed, but a rather sharp tang, which was best dispersed by giving the toilet room a short airing on arrival at the new site.

One asset of the closet is that you do not have to consider whether you are wasting chemical. You can tip as frequently as you like or as is convenient. Each use of the closet is neutralised at once by pressing the vacuum switch provided. The user can then go away and forget it; after a prearranged time period the closet switches off itself. The current consumed is quite small, and could probably be supplied by a heavy duty dry battery.

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12 WATT PUBLIC ADDRESS AMPLIFIERS

From time to time we receive enquiries regarding the design of Amplifiers intended for such uses as Public Address Work, Home Listening, High Fidelity Recording, etc., and we feel that there are many who would like to share the results of these queries.

We present as number one in a series of Amplifier designs, the circuit of a low power Public Address Amplifier suitable for the average size hall or public meeting.

The design follows modern practice with a minimum of parts necessary to suit the design requirements.

It is generally agreed that a power output of 10-15 Watts is necessary to accommodate the average size hall with the output being divided by two or three 12" cone type speakers in the case of a dance hall or, say two 8" cone type speakers with flares for the outdoor function.

Two type 6V6G tubes operated Class AB1 with a supply voltage around 300 volts will satisfy the power requirements.

Grid drive for these tubes can be best derived by using an interstage transformer since it provides a push pull drive with a stage gain and allows the full gain of the driver tube to be realised.

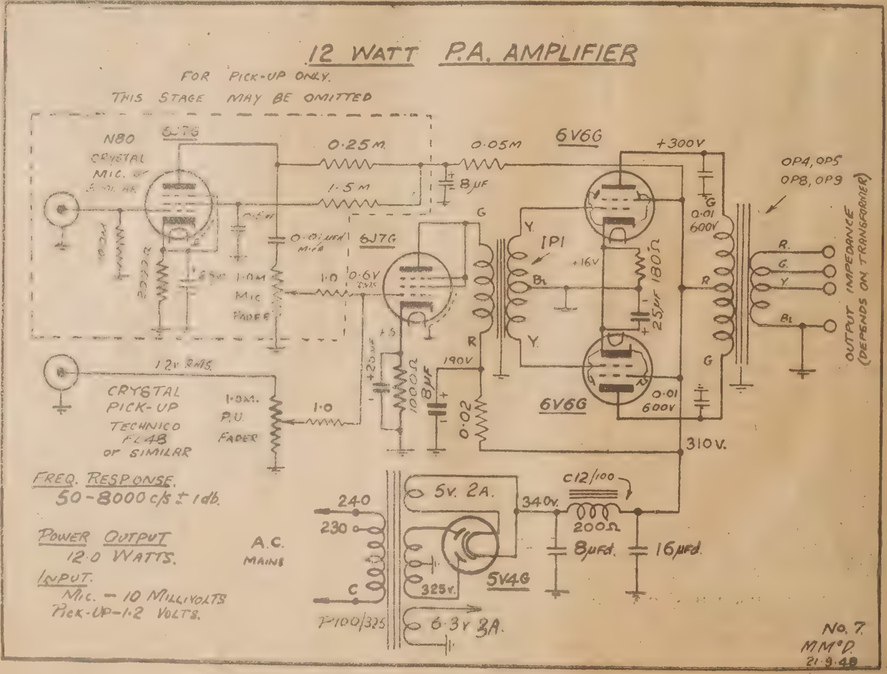
A low D.C. grid resistance is also advantageous in obtaining slightly greater power output.

Two input channels have been provided, one for a crystal microphone, the other for a crystal pick-up, with a suitable mixing arrangement that exhibits negligible interaction.

Crystal type units have been chosen from the economical point of view, they exhibit the highest output for a given response —thus reducing the tube line up.

Should it be desired to use the Pick-Up only, the microphone pre-amplifier stage can be omitted as shown by the dotted line.

For Portable P.A. work the A.C. power supply shown could be replaced by a 300V. 100 M.A. genemotor operating from a 6V. car accumulator.


12 WATT P.A. AMPLIFIER
FOR PICK-UP ONLY.
THIS STAGE MAY BE OMITTED
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6J7G
CRYSTAL
MIC.
0.25M.
1.5 M
0.05M
8μF
6V6G
+300V
0.01μF
MICA
6J7G
1.0M
MIC
FADER
1.0
0.6V
RMS
G
IP1
Y
BL
+16V
180Ω
25μF
0.01
600V
R
OP4, OP5
OP8, OP9
R.
G.
Y.
BL
OUTPUT IMPEDANCE
(DEPENDS ON TRANSFORMER)
+5
+25μF
1000Ω
8μF
190V
0.02
6V6G
0.01
600V
310V.
1.2V RMS.
CRYSTAL
PICK-UP
TECHNICO
FL48
OR SIMILAR
1.0M.
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FADER
1.0
FREQ. RESPONSE.
50-8000 c/s ± 1db.
POWER OUTPUT
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MIC. — 10 MILLIVOLTS
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MAINS
240
230
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5V. 2A.
325V.
6.3V 3A.
5V4G
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340V.
200Ω
8μFd.
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TRADE REVIEWS AND RELEASES

EDDYSTONE 640 COMMUNICATIONS RECEIVER

Of special interest to Australian amateurs is the release on the local market of the Eddystone 640 Communications receiver. Available through various trade houses, it is imported in the first instance by Keith Harris & Co., Pty. Ltd., 51 William St., Melbourne, C1.

DESIGNED particularly with amateur requirements in mind, the "640" covers a tuning range of from 1.7 to 32mc, in three bands. The dial is directly calibrated in terms of frequency and a second 3-gang tuning condenser provides full bandspread.

The gang condensers are mounted side by side and their setting is indicated by separate pointers operating on concentric shafts, the tuning knobs being of large diameter for ease of control. The tuning mechanism is very smooth in its action.

The valve line-up includes an EF39 RF amplifier and two more as IF amplifiers. The converter valve is a 6K8-G and the audio section includes a 6Q7-GT and a 6V6-GT. The rectifier is a 6X5-GT. An EB34 serves as a noise limiter and an additional EF39 as a BFO.

Low noise characteristics are claimed for the RF end, with ample selectivity and image rejection. Variable iron-slug coils are used, with ceramic air trimmers in the oscillator section. The whole tuning unit is housed in a die-cast sub-chassis.

The IF channel operates at 1600kc and is provided with a crystal filter system. A vacuum crystal is employed and the adjacent channel rejection is 45 db. Switching in the crystal has a minimum effect on the overall gain, the phasing and in-out controls being accessible from the front panel.

The BFO is completely shielded and the degree of injection adjusted beforehand of optimum results. Pitch is controllable, in the usual way from the front panel.

The audio circuits follow normal practice, with provision for the attachment either of speaker or earphones.

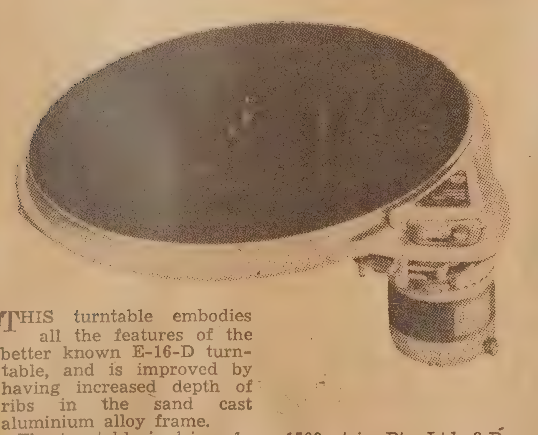
The receiver has both audio and HF gain control, with non-delayed AVC to allow best use to be made of an external "S" meter.

Each receiver is accompanied by a comprehensive manual.

Tested at a typical amateur station, the receiver performed in a manner consistent with manufacturer's specifications. Tuning is smooth, noise level low, while the crystal filter is particularly effective and simple to adjust.

BYER 2-SPEED TURNTABLE

Latest release from Byer Industries is this two-speed transcription turntable, model E-16-H. A change in speed from 78 to 33 rpm involves simply the moving of a single lever control, which is located just above the drive motor.



THIS turntable embodies all the features of the better known E-16-D turntable, and is improved by having increased depth of ribs in the sand cast aluminium alloy frame.

The turntable is driven by a 1500 rpm synchronous motor which is rubber suspended, and the pulley drives on a rubber band which can be easily replaced if required.

Retail price is £56/5/- for the 16in. and £53/2/6 for the 12in.

Distributors are as follow: Birnbach Co. Pty. Ltd., 55 York Street, Sydney, for New South Wales; A. E. Harrold, 123-125 Charlotte Street, South Brisbane, for Queensland; Byer Industries Pty. Ltd., 8 Dorcas Street, South Melbourne, for Victoria, and L. S. Wise and Co., 14 Pirie Street, Adelaide, for South Australia.

FERGUSON TRANSFORMERS

ADDING to their existing range of products, Ferguson's Radio announce a new line of high-grade power transformers, vertical mounting and finished in black brocade.

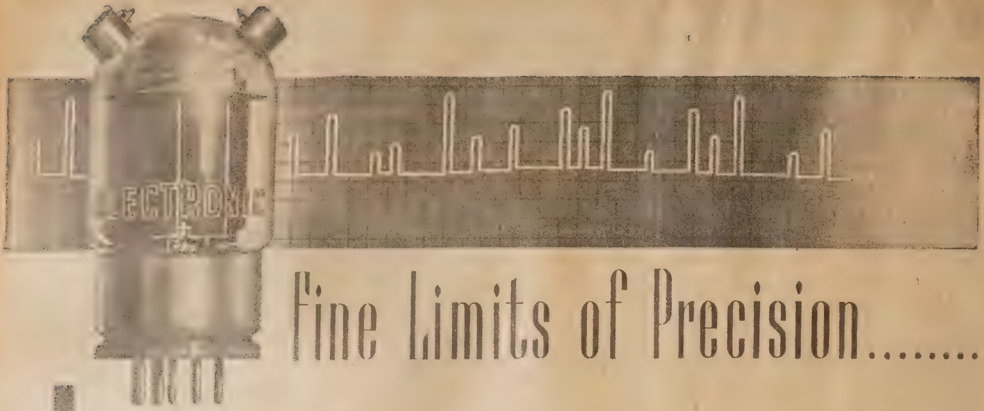
Primary voltage in each case is 240 tapped at 230.

The 60 milliamp transformer can be supplied with a high tension winding delivering 285, 325 or 385 volts per side, with one 6.3 volt 2 amp filament winding and a 5 volt 2 amp winding for the rectifier.

The 80 milliamp transformer could be supplied in the same range of high tension voltages but has an additional 6.3 volt 2 amp filament winding.

At present the 100 milliamp transformer could be supplied only with a 285 or 325 volt secondary, two 6.3 volt 2 amp filament windings and one at 5 volts at 2 amps.

Larger rating transformers will be available shortly. (Available through normal distributors. Trade inquiries to Ferguson's Radio, 12 McMahon Street, Willoughby, NSW.)



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Multi-range A.C.-D.C. 50 ranges. Indication on 5" hand calibrated scale. Range selection is by two switches for A.C. and D.C. respectively — press button gives additional range for each value of current and voltage shown on the switch knobs. An automatic overload cut-out is fitted to protect the instrument against misuse. The wide range, the type of measurement covered and small power consumption make this meter suitable for Radio Testing and General Engineering. Accuracy is within B.S. 1st Grade limits.

FINE limits of precision are yours when you use the AVO range of electrical measuring instruments. World-famous for ability to withstand rough usage, without variation in fine limits of electrical measurement, AVO has an instrument for every application.

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A.A.2

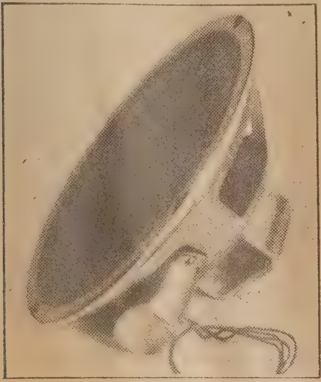
HERBERT STREET, ST. LEONARDS, N.S.W. P.O. BOX 29, CROWS NEST. TEL.: XF 1042

TWO NEW LOUDSPEAKERS

Reflecting the trend to higher fidelity, two new loudspeakers have made their appearance on the Australian market.

THE one illustrated below is the latest Amplion 12 inch, which retails for approximately £4/4/-. It has a completely new cone and voice coil assembly, which gives a substantially level response from 40 to 7500 c/s, with diminishing response thereafter.

The voice coil impedance is 6.5 ohms at 400 c/s and the cone resonant frequency is approximately 70 c/s. Magnetic flux in the air gap is 10,000 gauss and the power handling capacity, when correctly loaded, is 15 watts.



Type AV38 is fitted with a 5000 ohm transformer, while type AV39 has a 12,000 ohm C.T transformer.

AXIOM TWELVE

In the higher priced field, an interesting speaker is the new Goodman's Axiom Twelve, which is distributed in NSW by United Radio Distributors, of 139 Phillip Street, Sydney.

The Axiom Twelve is normally supplied with a twin curvilinear cone, which maintains the response substantially level from 40 to 15,000 c/s. Retail price of this version is £15/6/-. A similar speaker, with a single cone, has a response from 50 to 10,000 c/s and retails for £12/5/9.

The speakers have a magnetic flux of 13,000 gauss and are fitted with a 15-ohm, 1¾-inch voice coil. They have a cast rather than a pressed metal housing, with an overall diameter of 12 inches.

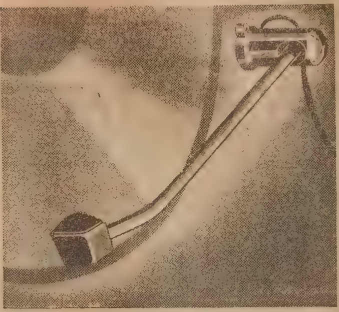
Limited stocks are coming forward regularly.

A Chicago scientist named Dr. Eugene Geiling once crawled through the gullet of a dead whale to prove that a whale could have swallowed Jonah. His comment: "A pretty slimy trip!"

THIS IS THE

GOLDRING

LIGHTWEIGHT



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PICK-UP!

The Goldring lightweight Pickup (No. 121) is the result of years of intensive research and experiment in sound reproduction. At last here is the ideal Pick-up with the absolute minimum of needle pressure—less than one ounce in weight—and yet which follows the groove of even the lowest recorded frequencies (25 cycles) faithfully and without distortion. On the other hand, this Goldring reproduces the full strength of an orchestra without any chance of it jumping from the groove—and the total absence of needle talk makes it possible to play records without the lid of the player having to be closed. Perfect pivoting enables the pick-up arm to move absolutely freely both horizontally and vertically in every position, and this feature, combined with the other special advantages of the Goldring, makes it the obvious choice of discerning music lovers.

NEW LIFE TO OLD RECORDS!

Because of its lightness and maximum sensitivity, the Goldring will give new life to old and worn recordings. Records once thought worn out will delight with their trueness and volume.

GOLDRING **Price only 63/1 ea.**

SAPPHIRE *NEEDLES!* **12/8 ea.**

Exhaustive tests have shown that no needle gives better results than the Sapphire Jewel Point Needle. Specially developed for the Goldring Lightweight Pick-up is the Miniature Sapphire Needle (S3). Other types of Goldring Sapphire Jewel Point Needles are: The Straight Type (S1), Trailer Type (S2) and the Knee-bent type (S4) (specially recommended for Record Changers).

Features of the Goldring Sapphire Jewel Point Needles

1. They are scientificially designed.
2. Their shape is matched to that of the recording stylus.
3. They are highly polished.
4. They are shadow-graphed to 500 times their size to detect any possible faults.

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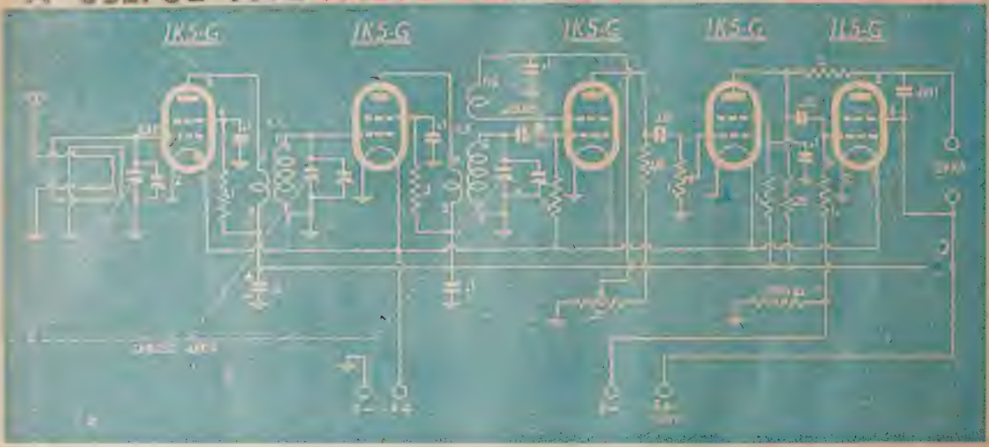
A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A USEFUL FIVE-VALVE BATTERY T.R.F. RECEIVER



A reader from Scone, NSW, is very pleased with the results he obtained from a five-valve battery T.R.F. set. It served as a domestic receiver and as a portable, and the circuit is published for the interest it may have for other experimenters.

REPORTING on its performance, the constructor, Mr. J. R. Carter, says: "When I first built the receiver, it had only three valves. The performance on speaker was not quite good enough for country use, although quite okay on phones.

"I then added two RF stages, and it had ample power to drive an 8in. loudspeaker. At night, using only the loop aerial, it would bring in interstate stations like the locals.

"Hook an external aerial on, and it would play very loudly with the volume control only half on. I use this set occasionally in rough mountain country with only the loop aerial, and would like to hear from other readers who may care to try out the design.

Reviewing Mr. Carter's circuit, it employs a standard commercial loop, an RF coil and an RF coil with reaction. The coils are tuned by a three-gang condenser fitted with trimmers across each section.

There are two RF stages using 1K5-G valves — chosen in the first instance because they were cheap and plentiful. No provision for gain control is made ahead of the detector, overloading trouble apparently not being present because the set was normally used with a loop or in areas where the signal strength from stations is comparatively weak. Under other conditions, it would normally be necessary to provide some form of RF gain control, such as a potentiometer to control the screen voltage of the first two valves.

The detector is a 1K5-G, with screen circuit reaction and control. Another 1K5-G serves as the first audio amplifier, feeding into a 1L5-G in the output stage.

Comparing this circuit with our own "1K5-Four" receiver (R & H, May, 1947), it is noteworthy that Mr. Carter has not provided decoupling in the plate circuit, but this could be added very simply if a tendency to motorboat is evident in an individual receiver.

Another point is that no bias is provided for the 1K5-G audio amplifier, whereas we used -1.5 volts in the "1K5-Four." Experimenters could check on the precise effect of operating with and without grid bias on this stage.

For the output stage, back-bias is provided, thus eliminating the need for a C-bias battery.

Mr. Carter says that he has used the receiver as a portable, and operated it entirely from small batteries. Two 67.5 volt batteries in series provided the high-tension supply, while the filaments were operated from a cycle battery. When the battery was new, the voltage was reduced by connecting a length of resistance wire in series with the A-plus lead, the wire becoming unnecessary as the battery voltage became lower after use.

(Mr. Carter is living temporarily in Sydney, his present address being 20 Edwin Street, Mortlake, NSW.)

AN EXPERIMENTAL FM TUNER

(Continued from Page 33)

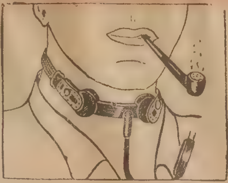
Suitable marks on the dial scale, or a record of the readings should assist materially in this direction.

If one side response is now found to be much louder than the other, even though they are eqcally displaced, try the effect of varying slightly the setting of the primary trimmer to bring the two responses to the same level.

All this may appear to constitute a great deal of "cut and try" but there appears to be no other way out of the alignment difficulty which attends all FM receivers. The best approach for the home constructor has yet to be demonstrated.

However, once you have the tuner in operation. You will be able to pick the live programmes, and the good records from the bad as they are fed in at the transmitting end.

Needless to say, your amplifier and speaker must be good. The two things which can make FM sound very ordinary are a poor speaker and treble cut tone control.



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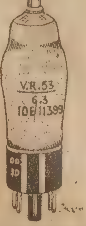

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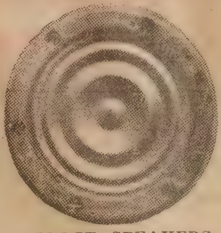
Brand new White Cotton Shirts, collar attached, long sleeves—size 16½in. only, 12/6 ea. Post 1/-. New Khaki Cotton Shirts, Army style with 2 pockets, sizes 14½ to 16½ inch, 12/6 ea. Post 1/-. These shirts are excellent quality material and well cut.



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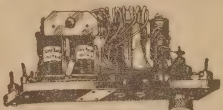

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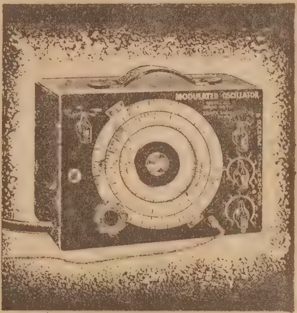

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F.M.

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A high grade moving coil pick-up for the discriminating recorded music enthusiast. The output is exceptionally good and free from undesirable resonances. Response is substantially flat from 250 to 12000 cycles. The pick-up is of the low impedance type and is supplied with a matching transformer.

We do not recommend the Shefi Pick-up for use with the average radio set or amplifier, but it will be found hard to beat, when used with a high fidelity outfit.

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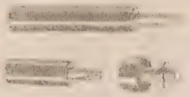

Just landed from England [illegible] quality spiral slotted plugs ensure good contact. Socket has special insulator to ensure freedom from [illegible].

Sockets. Red or black 7½d each

Short plug. Red or black, 7½d each

Long plug. Red or black, 9d each

FERROCART PICK-UP

This is a light-weight crystal pick-up with an output large enough for the smallest amplifier, yet capable of giving excellent reproduction. The crystal cartridge is robust and will stand up to hard wear. Full instructions are supplied so that the best possible results can be achieved.

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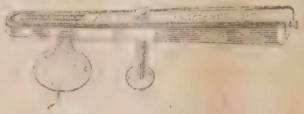

A standard type magnetic pick-up of robust construction, chrome plated metal arm with colored top panel. Can be used on any radio set that is fitted with pick-up terminals.

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Postage 1/6 extra

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The set is soundly constructed on a wood base with slider tuned coil. Universal joint type crystal detector makes adjustment easy. Supplied complete with crystal. (Headphones extra.)

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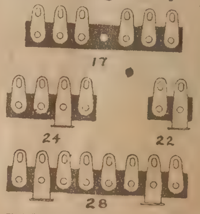

Without mounting feet.

Type	12	Single lug	1/-	doz.
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,,	14	Three lug	2/-	,,
,,	15	Four lug	2/6	,,
,,	16	Five lug	3/-	,,
,,	17	Six lug	3/6	,,
,,	18	Six lug	3/6	,,

With mounting feet.

Type	22	Single lug	1/6	doz.
,,	23	Two lug	2/-	,,
,,	24	Three lug	2/6	,,
,,	25	Four lug	3/-	,,
,,	26	Five lug	3/6	,,
,,	27	Six lug	4/-	,,
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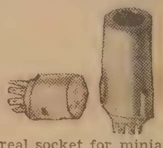
AWA Miniature Sockets



A real socket for miniature valves. High grade insulation with efficient contacts. Shield register forms part of the socket and shield presses valve firmly into socket. It cannot vibrate out. **2/10**

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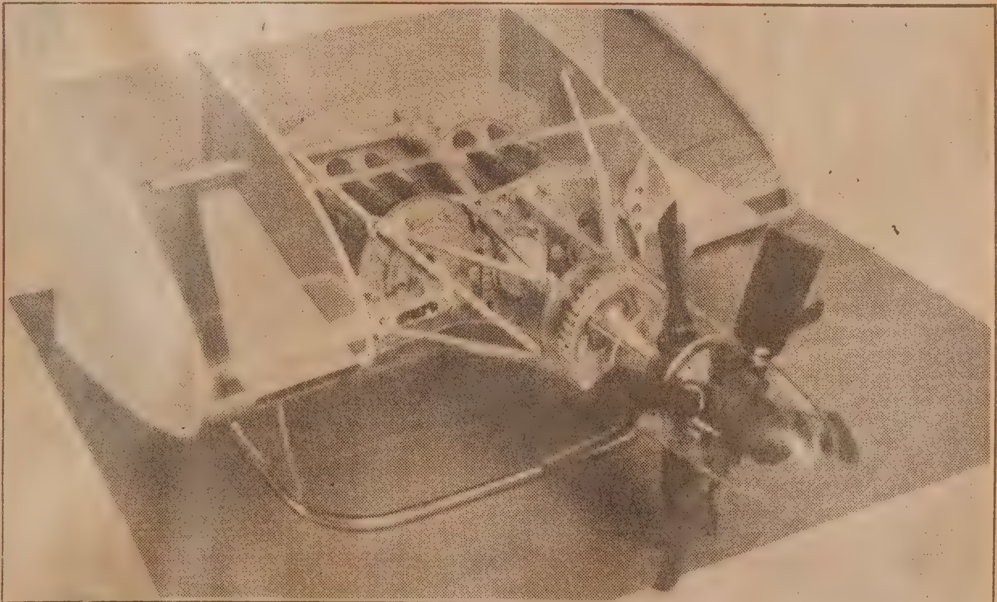
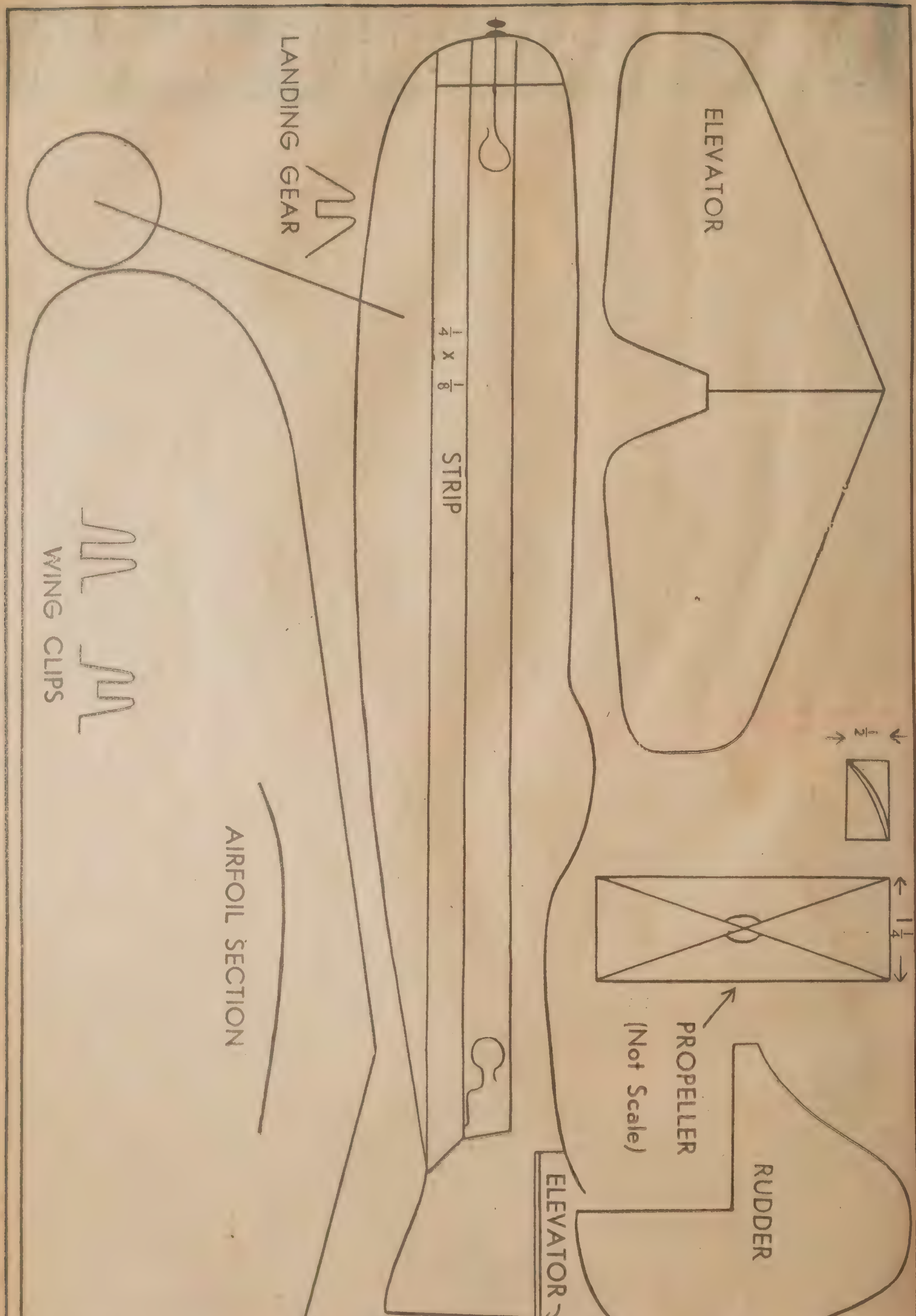


A Perspex model of the British "Bristol" Proteus coupled propeller turbine showing how the two units are coupled together to drive the two contra rotating airscrews.


ELEVATOR
LANDING GEAR
$\frac{1}{4}$ x $\frac{1}{8}$ STRIP
WING CLIPS
AIRFOIL SECTION
$\frac{1}{2}$
$1\frac{1}{4}$
PROPELLER
(Not Scale)
RUDDER
ELEVATOR

A DUAL PURPOSE MODEL AEROPLANE

Continuing with our series of simple all-balsa model planes, we feature this month a profile design which turns in a nice performance, whether flown as a high-wing or a low-wing model. For good measure it can be made to perform simple aerobatics.

by Jack Finneran

THIS little machine, when well built, can actually be made to lead quite a "Dr. Jeykll and Mr. Hyde" existence, since changing the wing position from high to low completely changes the appearance and also the performance characteristics of the plane.

You will find that the model, although simple in construction, will give you quite a kick out of its performance. It is capable of steep climbs and a slow floating glide, particularly when flown as a high-wing ship. The addition of a little more power will result in some first-class aerobatics, particularly loops and snap rolls.

A change from the high-wing to the low-wing position will result, alternatively, in a faster, straight-away type of flight, with a much shallower climbing angle with less tendency towards aerobatics. It will come in to much nicer landings, too.

It is not necessary to do any scaling up of plans to build this plane, but it is suggested that you use some tracing paper and transfer the plans from the magazine direct to some stiff cardboard. You may then cut out your templates and use them to duplicate the required parts in balsa.

We have stressed the idea of using cardboard templates in the construction of all our all-balsa models and feel sure it is the best method, as it is so convenient. By keeping the templates together, you may at any time, duplicate the plane concerned, either completely or in part, and be sure of having an absolute replica of the original.

LIST OF MATERIALS REQUIRED

1 sheet 1-16in x 3in x 36in light balsa.

1 sheet 1-8in x 3in x 36in medium balsa.

1 block 6in x 1in x ½in medium balsa.

20in 22 SWG piano wire for hooks, landing gear, wing clips.

2 cupped washers for propeller bearings.

2 small lightweight wheels.

2 yards 1-16in x 1-16 model aeroplane rubber.

1 bottle model aeroplane cement.

1 bottle model aeroplane dope.

Miscellaneous equipment required will mainly be a sharp pointed knife, razor blades, pins and sandpaper.

FUSELAGE CONSTRUCTION

The sheet of medium balsa is used for the fuselage, which is cut out by using the cardboard template. This will produce the fuselage side view and, because the fuselage remains just a thin strip of balsa in the top view, it thus is called a profile fuselage. This is a very simple method of securing a reasonable likeness to a built-up machine, without any complication in construction.

Having cut out the side view of the fuselage, it will now be necessary to remove the strip down the centre by cutting out with a knife and straight edge. This leaves a gap practically the full length of the fuselage, to accommodate the rubber motor and propeller shaft. Balsa strips, as noted on the drawings, are now cemented in place to stiffen up the fuselage structure and to carry the front bearing.

Smooth the completed fuselage over by the liberal use of sand paper, round all corners and get the smooth flowing lines of the nose section right. Give the completed fuselage two coats of dope and sand lightly between each coat. This will ensure a strong, lightweight structure, capable of taking plenty of punishment.

If you have a mind to be decorative, you can cover the complete fuselage with colored tissue paper, which will further strengthen it. But don't overdo the decorations, as too much added weight can seriously affect flight performance. Before laying the fuselage aside, cement the rear hook in place and also one of the cupped washers which acts as the propeller shaft bearing.

TAIL SECTION DETAILS

Select a piece of 1-16in thick light balsa sheet 3in wide and, using your cardboard templates, cut out the outlines of the vertical and horizontal tail sections. Make good use of your sandpaper here to secure a smooth finish and level all edges down to a nice sharp point. The main consideration here is to keep the weight down, consistent with strength, mainly because any tendency in the complete plane to a tail-heavy attitude militates against its performance.

Having completed each section of the tailplane separately, cement the two together and make sure that you get the rudder at right angles to the stabiliser section.

WING CONSTRUCTION

When the cement has set, you may glue the tailplane to the fuselage and make sure the rudder lines up correctly with the fuselage both top and bottom, so as to maintain the free-flowing lines of the original.

Perhaps the most important part of this or any model aeroplane is the wing, for it determines more than any other part, how well the model will perform.

Select the sheet of soft balsa and cut out the wing outlines, using the template as previously explained. Be sure you make a left and a right-hand panel since, due to the section in the wing and the dihedral angle, it is not possible to make the wing in one piece as with the glider models. Form an airfoil section into the wing, either by cementing small airfoil shaped ribs in place or by steaming the balsa over the spout of a kettle and holding the shape until dry.

Both methods are quite satisfactory but, in any case, use a rib at the centre section where the wing joints, as this will considerably strengthen the structure at this point.

The wing must also be assembled in the form of a shallow "Vee." This gives what is known as the dihedral angle, which is necessary if the model is to give stable flight characteristics.

The drawing shows the means used to secure this angle and is largely self-explanatory. Don't forget to smooth things up with that piece of sandpaper. It does add so much extra appearance to any model.

WING CLIPS

A variation of the once popular wire wing clips is used on this model to get a fixing for both high and low wing positions.

Using 22 S.W.G. wire, bend the clips to the shape shown on the plans. You will notice that there is a variation in the depth of the centre slot. Make two clips to each pattern and cement to the wing as follows: One shallow clip is placed at the wing leading edge on the top surface and one at the trailing edge on the bottom surface. The deep clips are placed at the leading edge of the bottom surface and at the trailing edge of the top surface. Make sure you get this set up correct, as otherwise the correct wing incidence angle will not be attained and the machine will not fly. These clips are adjusted to hold the wing to the fuselage in both the high wing and the low-wing position.

You may now assemble the machine by clipping the wing in position and checking over the alignment to see that it is squared up with the tail plane. Remove any twists or warps at this stage by steaming

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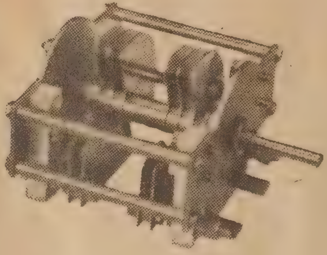

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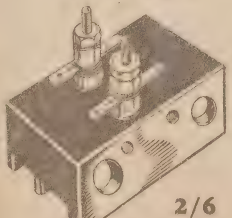

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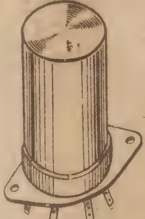

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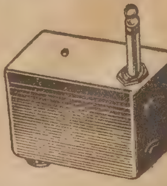

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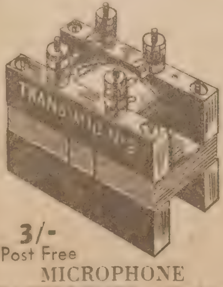

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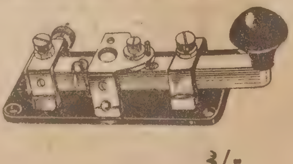

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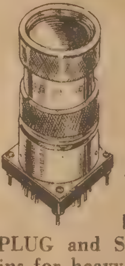

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and twisting the faulty parts back into alignment. Bend the undercarriage as per the plans, fit the wheels, and cement securely in place.

CARVING THE PROPELLER

First take the propeller block and draw diagonals across the face of it. At the intersection of these diagonals, drill a hole at right angles to the face of the block for the propeller shaft. Remove all the timber outside of the diagonal lines and the hub section, leaving the blank from which the blade angles will be formed. The blade angles are formed by carving away the balsa from corner to corner, as suggested in the end view of the block, leaving the thin section of blade as indicated.

This leaves us with the screw-shaped blades which are now rounded at the tips and nicely sanded to a smooth finish. The propeller must be balanced on its shaft so that each blade weighs the same, as otherwise uneven running and severe vibration will result. A well-balanced propeller will give smooth running and add zip to the performance of your plane.

If you are in doubt about the propeller it may be wise to secure a ready-made one from a model plane supply shop.

Having satisfied yourself with the propeller and general alignment of your plane, fit the propeller shaft and washer as indicated in the plans and loop four strands of rubber between the hooks provided.

FLIGHT ADJUSTMENTS

Adjustments for flight trim remain the same, regardless of whether the model is flown as a high-wing or low-wing machine.

Balance the model at about one-third back from the wing's leading edge and wind about 100 turns into the motor. Launch with a gentle spearing action and note the flight behavior. Try to secure a smooth, shallow climb without stalling or diving tendencies. A steep climb followed by a dive will require the wing to be removed rearwards, while a steep dive will require the opposite treatment.

Make the adjustments carefully, only altering them slightly each time and get to know what effect they have on your model's performance. When you are getting satisfactory results in the general way, you may then go in for aerobatics.

The suggestion is that you add another loop of rubber, wind the motor a little tighter and launch with the nose pointed slightly upwards. The unrehearsed series of manoeuvres to follow will undoubtedly give you a great thrill. Happy landings!

HINTS AND KINKS FOR MODEL PLANE BUILDERS

- Attention, Glow Plug users, don't use more than 1½ volts on those plugs. They just don't stand up to it.
- If you are considering the construction of high-speed models, I suggest you give the all-metal construction serious consideration.

"BY THE MARK FIVE"

Heaving the lead from an outboard cradle is a picturesque though risky job for a quartermaster. Human error sometimes creeps in, endangering life and property.
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For details of the Receivers listed below, refer to our advertisement in R & H June edition.

Receiver type ZB2 (ARRI) frequency 236 to 258 mc/s. Usual price £3/19/6, reduced to £2/19/6.

BC/733/D frequency 108 to 110 mc/s, equipped with 3 crystals and 10 valves, less genemotor and aerial. Usual price [illegible]/10/-, reduced to £5/10/-.

[illegible] receiver frequency 75 mc's, [illegible] Usual price £2, reduced to 30/-. [illegible] Receiver uses 6 valves plug-[illegible] with one coil, usually [illegible] to £4.

RADIO COMPASS RECEIVERS

We have a few of the following types: Bendix type MN26, frequency range 150 to 1500 KC/s. Input voltage 28 DC, has built in genemotor and tuning motor. The following valves are used:

5/6K7, 2/6N7, 1/6B8, 2/6J5, 1/6L7, 1/6F6.
Price with valves £20

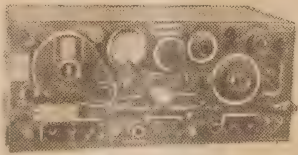
Less valves £10

Bendix 413A, equipped with 11 valves. This receiver operates off 12 volts DC and has built-in genemotor. Price £20. Bendix 373A. A 12 valve set with built in genemotor, less valves, £10.

Any of the above sets can be easily converted into excellent Broadcast sets and are admirable for DX work and reception in country districts where conditions are poor.

RADIO LOUDSPEAKERS

3in. Permag, less Transformer, in perfect condition 12/6
5in. Permag, less Transformer, in perfest condition 17/6
8in. Electro Dynamic, 5000 ohm Trans, 1500 ohm Field. Popular brand .. 19/11
6in. Cones, less voice coil 2/-
6in. Cones, with voice coil 2/6



RADIO TRANSCEIVER

No. 11 (illustrated):

Transceiver equipped with 9 valves and power unit valves uses 1C7G, 1M5G, 807, etc.
Frequency 4—7 mc/s £8/10/0
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A few left type 101 transceivers equipped with 8 valves and frequency supply, 4 to 6 mc/s £6/0/0
Less power pack £4/0/0
No 19:—
Transceivers. We have just obtained a very few of these and can offer them as follows:—
No. 19 equipped with valves and power supply to work off 12 volts .. £12/10/0
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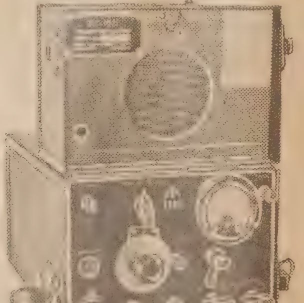

RADIO TRANSCEIVER

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1H4G C.O. to 1J6G parallel conected P.A. Plate modulated by Class B 1J6G driven by 1L5G from Carb. microphone. Freq range 3 to 7 megs. Aerial matched by network.
Receiver uses 1D5GP RF stage, 1C7G mixer, 1D5GP IF amp, 1D8GT Det first audio & BFO, 1L5G output.
Excellent for bush fire brigade work, etc. All dry battery operation. Price £12/10/0. Batteries extra.

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This batch of well-known 0-1 ma. meters are slightly damaged, but there is no reason why any man with a little technical experience could not do the repairs necessary and have a perfect meter.
Usual price £1. SPECIAL PRICE 10/-

VCR97 CATHODE RAY TUBE

This is an excellent 6in cathode ray tube with electrostatic deflection, 4 volt filament, extra sharp focus, green screen, short persistence. Excellent for use in oscilloscope and used extensively in England for Television.
Price only 38/6 inc. duty. Socket to suit same. Price 5/-.
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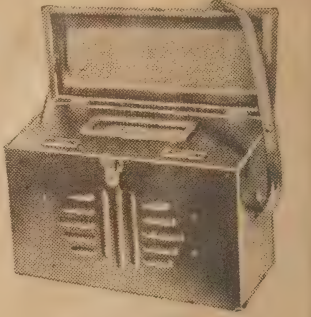
2X2 High Voltage rectifiers for Cathode Ray tube. 14/-. Includes duty.
866 JR Mercury Vapour Rectifier. 22/9 inc. duty.



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We are able to present to our clients the cheapest 5 valve Portable available. This Cadet Radio performs well, is ruggedly constructed and has nice appearance. Just the radio for the holidays.

Features are: 5 Miniature valves, 2/1T4, 1/1C5, 1/1R5 and 1/3S4.

A tuned RF stage ensures long range. 6in Speaker produces excellent tone. Batteries: 1/3745 "A" Battery.
2/P45 "B" Batteries giving long life, approx. 300 hours. The set can be carried over the shoulder or by means of a handle as desired.

Reduced from £28/10/- to £19/19/-.

PERSONAL PORTABLE RADIO

We have a limited quantity of 4 Valve Personal Portables, using the following valves; 1T4, 1S5, 1R5, 3S4. Equipped with 3in. Speaker, 1-67½ volt Battery, two torch cells. Usual price, 19 gns. Bargain price £12/19/6

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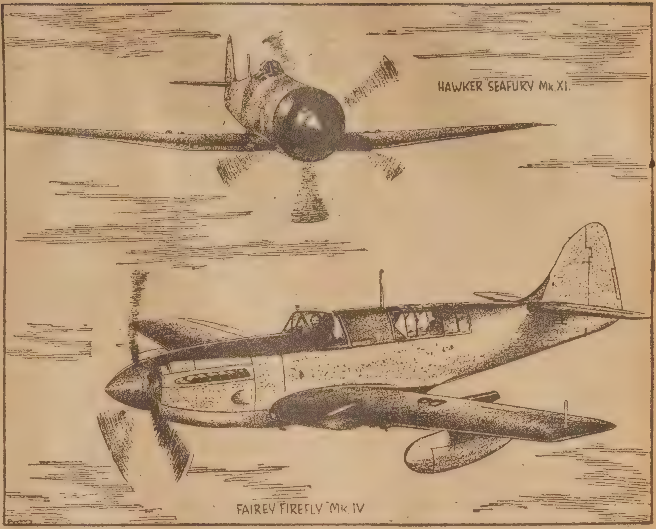
MODERN AIRCRAFT FOR THE R.A.N.



Two British-built aircraft types have been chosen to give air strike and defence power to the two light fleet carriers ordered for the Royal Australian Navy. The first of these carriers is expected to reach Australian waters early next year.

AUSTRALIA'S first naval aviation aircraft will be the Fairey Firefly Mk. IV and the Hawker Seafury Mk. XI. These two planes are sketched here in flight.

The Firefly is an anti-submarine, reconnaissance and strike aircraft. A two-seat low-wing monoplane, it is a well-established carrier machine that has appeared in a number of versions since first in action with Royal Navy carriers. Fireflies scored their first combat success in an attack on the German battleship Tirpitz, when Firefly fighters engaged enemy aircraft attempting to break up British bomber attacks.

FAIREY FIREFLY

The Firefly Mk. IV is powered by a 12-cylinder Rolls-Royce Griffon 74 engine, incorporating a fuel injection pump. This motor develops 2000 horsepower at 2750 rpm for takeoff.

Four 20mm cannon are fitted, two mounted in each wing. The plane also mounts a camera for vertical photography.

The wings are stepped back and carry hinged flaps, which extend along the trailing edge for more than half the length of each wing.

The landing wheels retract inwards. The wings can be folded to simplify the stowing of the plane in carriers.

Maximum speed of the Firefly Mk. IV is 386 miles an hour at 14,000 feet. Maximum range with standard tanks when cruising at 210 miles an hour is 760 miles. Auxiliary fuel tanks mounted beneath each wing tip, as seen in the sketch, increase the maximum range to 1300 miles.

All-up weight of the aircraft is 13,500lb.

Main dimensions are: Wingspan, 41ft 2in; length, 38ft 9in; and height, 14ft 4in.

The Hawker Seafury, the second of the machines to be used in HMAS Sydney and Melbourne, comes from a long line of outstanding single-seat fighters designed and built by the famous Hawker aircraft firm.

HAWKER SEAFURY

The Seafury Mk. XI is powered by a Bristol Centaurus XVIII engine. This air-cooled motor, a two-row radial 18-cylinder sleeve-valve type, gives 2480 horsepower for takeoff. It drives a five-blade variable-pitch airscrew.

Mounting four cannon, the Seafury has a top speed of 438 miles an hour at 21,000 feet. Its all-up weight is about 12,000lb. Landing wheels are completely retractable and the wings fold for easy stowage.

Maximum range, with standard tanks, when cruising at 320 miles an hour, is 760 miles.

Main dimensions of the Seafury are: Wingspan, 38ft 4in; length, 34ft 7in; and height, 15ft 10in.

These two machines will give Australia's naval aviation a solid start. They are both well-tried types of the highest efficiency.

The Royal Australian Navy's aviation programme is now moving along steadily, though the whole project cannot be said to have yet passed the embryo stage. Men are still to be trained to the exacting tasks of naval aviation—no small undertaking. A naval air station is being established at Nowra (New South Wales). Another station will be at Schofield, while a satellite may be provided at Jervis Bay.

Altogether, 4000 officers and men will be engaged in naval aviation when the RAN'S organisation is in full swing at the end of next year.

There is a big job ahead for Australians in gaining the knowledge and experience necessary to make it possible for them to take over from the Royal Navy's officers, under whose guidance and direction the project will begin.

NEW FLYING BOAT

A NEW high-performance patrol flying boat—whose four propeller turbine engines at take-off develop more horsepower per pound of aircraft weight than some modern fighter aircraft—is being constructed for the Navy by Consolidated Vultee Aircraft Corporation, San Diego, California.

Designated XP5Y-1, the new patrol plane has been designed for long-range day and night search of sea areas, rescue operations and anti-submarine patrol.

The XP5Y-1, largest flying-boat ever built by Convair, has exceedingly quick take-off and high speed. This performance is due to its powerful Allison engines and its advanced design, particularly a high length-beam ratio which results in superior hydrodynamic characteristics. It has a high wing and a single-fin tail.

Interior styling and furnishings for crew comfort of the XP5Y-1 are designed to improve personal efficiency. These interiors have been provided with no sacrifice in tactical efficiency.

Much of the hydrodynamic testing for the XP5Y-1 was done with a radio-controlled flying model, dynamically similar to the full-scale airplane. A non-powered catatpult model, both dynamically and geometrically similar to the full-scale flying-boat, was used to analyse landing characteristics. These techniques for hydrodynamic research, devised and perfected by Convair engineers, reduce the risk of trial-and-error modification of the first experimental plane, and will shorten the time from design to completion.

£54,000 PURCHASE ! !

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8-day luminous AMERICAN-LONGINES precision timepiece. Suitable cars, trucks, etc. Robust, will stand heavy duty. ½ actual size. PRICE, £6. Packing and Reg. Postage, 2/-.

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5½" dia. x 2½" deep. Accurate nav. compass. Aircraft type, liquid filled; complete with carrying box. Reconditioned as new £4/15/-

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Ceramic Insulation. .0005 MFD Capacity, useful for set builders, etc.

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MAKE AN ELECTRIC SHOCKING COIL

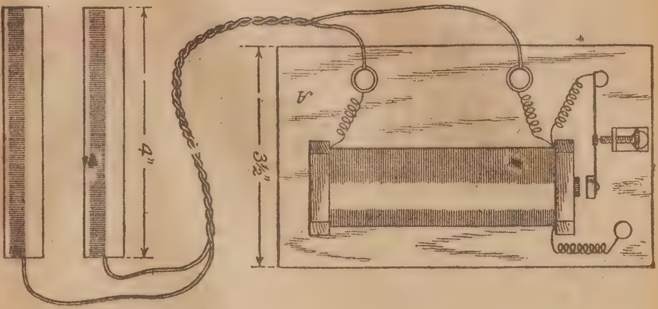

Fig 1.—Plan of the completed coil with hand grips.

A shocking coil is one of the oldest playthings in the electrical world. It is quite harmless provided that not more than 3 or 4 volts are used for the primary coil. This article tells you how to make one.

THE beginner will find the construction of this small shocking coil a fairly simple job, and when completed it will provide instruction and entertainment. The coil described can be made quite cheaply, and will work efficiently when connected up to a 4-volt accumulator or two large dry cells.

PRINCIPLE OF WORKING

Before dealing with the constructional details it may be as well to briefly explain the principle on which a shocking coil works. A shocking coil is an induction coil of simple form, and depends for its action on the peculiar property of electricity by virtue of which, when one coil of insulated wire through which an intermitten current of electricity is caused to flow is placed within another coil, a current of electricity is induced in the other coil. The inner coil in this case is known as the primary coil, and the outer one the secondary coil. To ensure that the electromotive force, or pressure, of the induced current shall be sufficiently high to cause a shock, the primary coil is wound round a laminated iron core, while the secondary coil or finer wire consists of a much larger number of turns than the primary winding. By means of a rapid make-and-break device the necessary intermittent current is caused to flow in the primary coil. It is on the rapidity of the make-and-break action that the strength of the shock depends.

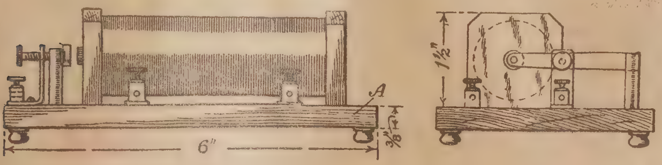

Fig 2.—Side and end views.

CONSTRUCTIONAL DETAILS

For the baseboard, A (Figs. 1 and 2), cut a piece of 3-8in. planed wood 6in. long and 3½in. wide. Ordinary deal will answer the purpose, and this can afterwards be stained and polished.

Two pieces of planed wood, 1½in. square and 5-16in. thick, will also be required for the end cheeks, B (Fig. 3), which support the core and windings. With a 5-16in. centre-bit bore a hole in the middle of each cheek for the ends of the core to pass through. Chisel off the top corners as indicated, and smooth the sides and edges of the cheeks and baseboard with fine glasspaper. The core consists of a bundle of soft iron wires, 4 3-8in. long, and this is covered with a layer of thin brown paper, the edges overlapping ¼in and stuck down with a smear of gum. The paper covering should be 3 7-8in long, so as to allow ¼in. of the core to be bare at each end, as indicated at C, C (Fig. 3).

COIL WINDING

For the primary winding, five yards of No. 22 cotton-covered copper wire will be required, and for the secondary winding 26 yards of No. 28 cotton-covered will be necessary. Carefully wind the primary wire on the paper-covered core, leaving a free end of about 6in. to start with, the same amount being left at the finishing end.

Bind the last two or three turns tightly with strong thread to prevent the coil from unwinding, and, after applying a coating of shellac varnish, cover the coil with a piece of thin brown paper. When quite dry wind on the secondary coil, leaving about 6in free at each end for connecting-up purposes. Bind the last two or three turns with thread, give another coating of shellac varnish and put on one side to dry.

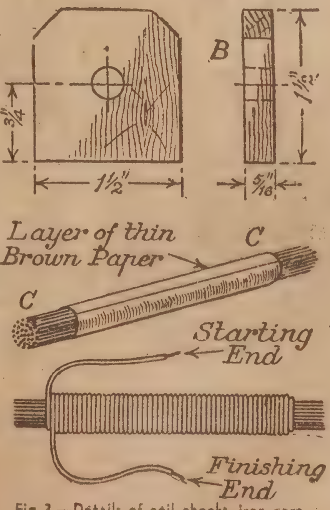

Fig 3.—Details of coil cheeks, iron core and primary winding.

MOUNTING THE COILS

To enclose the coils a thin cardboard tube 3 5-8in. long and 1 1-8in. daimeter, is used, covered by a piece of velvet or other material. Place the coils in the tube, make small nicks in the edges for the connecting wires to pass through and glue the wooden cheeks in place. One end of the iron core should project 1-16in. past the face of one cheek as shown in Figs. 1 and 2. Fix the coil in position on the baseboard by two screws driven into each cheek from underneath.

At this stage, four small wooden knobs, to serve as feet, can be fixed to the baseboard near the corners. The stems of the knobs can be glued into holes made in the baseboard.

CONTACT BREAKER

This consists of an armature spring, supporting pillar, contact screw and bracket. The armature spring can be made from a piece of thin, springy brass, about No. 35 gauge, cut to the dimensions given at D. (Fig. 4). The armature, E, is a soft iron disc 3-8in. diameter,

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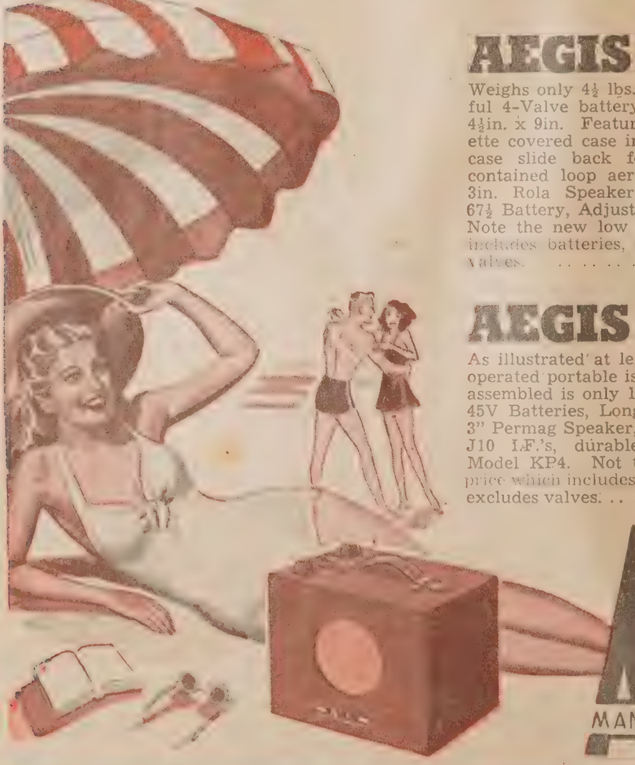

AEGIS "PERSONAL"

Weighs only 4½ lbs., yet the Aegis PP4 is a powerful 4-Valve battery operated portable only 4in. x 4½in. x 9in. Features include light-weight leatherette covered case in choice of colours with pencil-case slide back for easy battery change, self-contained loop aerial, midget 2-Gang by A.W.A., 3in. Rola Speaker, Super-Het Circuit, Minimax 67½ Battery, Adjustable Plastic Strap. Note the new low price, which includes batteries, but excludes valves. **£12/12/-**

AEGIS "VOYAGER"

As illustrated at left, this compact 4-valve battery operated portable is only 8in. x 6½in. x 7in. Weight assembled is only 12lbs., yet it includes 2 Minimax 45V Batteries, Long Life, Super-Het Circuit, Rola 3" Permag Speaker, Aegis special loop aerial, Aegis J10 I.F.'s, durable leatherette covered cabinet. Model KP4. Not the new low price which includes batteries but excludes valves. **£12/12/-**

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and 1-8in. thick, a hole being drilled through the centre so that it can either be screwed or riveted to the end of the spring.

The contact piece, F, is of silver, and for this part a link from an old watch chain can be used. Straighten out the link, cut off a piece about 1-8in long, and insert it in the hole, G, and burr it over on both sides of the spring by tapping it with a light hammer till a flat disc of silver is formed about 1-8in. diameter as shown in Fig. 4.

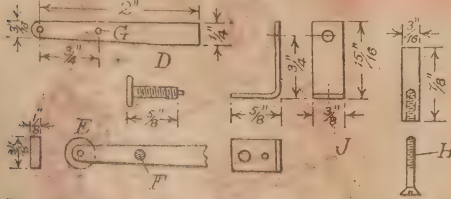

Fig. 4—Armature spring, supporting pillar, contact screw and bracket.

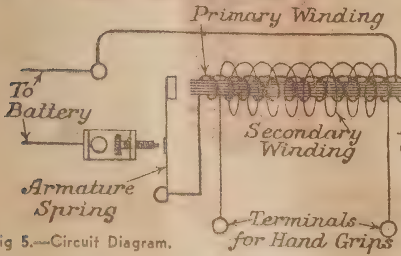

Fig 5.—Circuit Diagram.

For the supporting pillar a piece of brass rod 3-16in. diameter and 7-8in. long will be required, and this has a hole drilled and tapped in one end to take a countersunk screw, as shown at H. At the top end a flat is filed to take the end of the armature spring, which can be neatly soldered to the pillar as shown in Figs. 1 and 2.

CONTACT BRACKET

The bracket, J, for the contact screw is bent to shape from a piece of sheet brass 1-16in. thick, after drilling the two holes near one end for the fixing screw and terminal stem and drilling and tapping the hole at the other end for the contact screw. For the latter, obtain a brass screw, preferably with a milled head, and in the end drill a small hole and solder in a short piece of silver wire from the watch-chain link, leaving about 1-16in. projecting as shown in Fig. 4. Fix the bracket to the baseboard, in the position shown in Fig. 1, with a small round-headed brass screw and a terminal. Make sure that the end of the silver wire on the contact screw touches the centre of the silver disc on the armature spring when the latter is in its normal position. Another terminal can be screwed into the baseboard near one corner as in Fig. 1.

CONNECTIONS

Before making the connections it will be as well to form the free ends of the windings into spirals as indicated. This is easily done by winding the wire round a smooth wooden or metal rod about 1-8in. diameter. A more "business-like" appearance is thus given to the coil.

With the aid of a penknife, bare each end of the covered wire and fix one end of the thicker wire under the terminal near the corner of the baseboard. Clamp the other end of the thicker wire under the brass pillar which supports the armature spring. The end sof the finer wire, or secondary winding, are clamped under two terminals which also take the ends of the flexible leads attached to the hand-grips.

The coils can now be tested by connecting up to a single dry cell, the leads from the latter being connected to the two terminals at the ends of the primary winding as shown in the circuit diagram, Fig. 5.

On adjusting the contact screw so that the silver point presses lightly against the contact disc on the armature spring the latter should vibrate at a rapid rate, and continue to do so as long as the current is flowing. This indicates that the primary winding is all right. Now place the tip of a finger of each hand lightly on the two terminals attached to the secondary winding, when a slight shock will immediately be felt.

For the hand-grips, obtain two pieces of thin brass tubing about 5-8in diameter and 4in. long. A piece of twin-flex wire, 2ft. long, serves for the connecting leads. The wire is opened out at each end, two of the ends being soldered to the grips inside one end. The strands of wire at each of the other ends, after being twisted together, can be dipped in some flux and soldered, so forming solid ends for clamping under the terminal screws.

CHECKS LIQUID SURFACE DEPTH

STANFORD Research Institute just announced that the depth of a liquid surface has been determined to be about 1000 atoms, or approximately 0.000001in., indicating molecular attraction takes place over a wider range than believed.

The discovery can be applied practically in fields of lubrication, oil exploration, and biology, where reaction of liquid surfaces in contact with other materials is important.

Saffron is a species of crocus, which is used largely for coloring medicine, foodstuffs, liquors and confectionery. It takes about 4000 flowers to make an ounce of saffron dye.

THE JUNIOR EXPERIMENTER

(Continued from Page 59)

The color dot or band at the centre of the resistor shows the number of noughts which have to be added after the first two significant figures.

A black dot would indicate no noughts and therefore the resistance value would be merely 25 ohms. With a brown dot, the resistance value would be 2-5-0, or 250 ohms. In the case of a 2500 ohm resistor, the dot would obviously have to be red, and so would not be apparent on the red body.

By way of example, one may encounter a red resistor with a black end. Referring back to the list, the first two significant figures must be "20." The dot must be assumed to be of the same color as the body . . . red. This signifies two noughts, so that the value becomes 2-0-00, equals 2000 ohms.

To take another popular example, a green resistor with black end and yellow dot or band is 5-0-0000, equals 500,000 ohms or 0.5 megohm.

The accompanying table sets out the colors and figures in a form which simplifies the transfer from color code to resistance value, and vice versa. The second table shows the color codes directly for a selection of popular resistance values.

To simplify production, a few resistors from overseas sources are color coded in a somewhat different manner.

COLOR BANDS

Instead of being applied to body, end and band, the significant colors are applied as three parallel bands around the resistor and towards one end. The body color of the resistor has no significance whatever.

Hold the resistor so that the color bands are towards the left and read off the colors from the left to right. The colors have the same significance as before, so that no difficulty should be encountered on this score.

Assuming that the color bands on a resistor were, left to right, red, green and yellow, the resistance value would be 2-5-0000, or 250,000 ohms. Occasionally a fourth band is added, on the right, of either silver or gold. A silver band signifies that the resistance value is within 10 per cent of the marked value, while a gold band indicates a five per cent tolerance.

The use of color bands instead of body, end and dot colors should occasion no confusion, provided you remember to hold the resistor with the bands toward the left and read off the colors from left to right.

There is a whole lot more to the subject of resistors. We haven't even mentioned yet their physical construction or the important matter of dissipation and wattage rating.

We'll keep that in store for next month!

SHORT WAVE NOTES BY RAY SIMPSON

WELCOME TO RADIO NEW ZEALAND

ZL3 AND ZL4 NOW ON AIR

After carrying out tests for some few weeks beforehand, the New Zealand Broadcasting Service short wave stations, ZL3 on 11.78 mc and ZL4 on 15.28 mc took the air with regular programmes on New Zealand's Dominion Day, September 27. Both the above stations were heard at very good strength and should provide some interesting programmes for short wave listeners in many countries.

THE NZBS sent out an attractive folder prior to the stations taking the air and as the information they give is of general interest, we are reprinting some extracts.

Radio New Zealand aims to provide a service for the New Zealand Dependencies in the Pacific and for the Trust territory of Western Samoa, and at the same time to offer a programme of interest to listeners in other parts of the world. The transmissions, to start with, will be limited to two hours daily—5.0 pm to 7.0 pm Eastern Australian time.

Tests indicate that Radio New Zealand will be received with good strength in the Pacific Islands to the north of New Zealand and in Australia, and to a lesser degree in New Guinea, the Netherlands East Indies, Malaya, India, or, in short in the Middle and Far East. Reception in other parts of the world will be improved when new aerial arrays are constructed.

The policy of the short wave division is to provide a programme with maximum entertainment value. Approximately three quarters of the time on the air will be given to musical programmes; talks and news sessions will be brief.

New Zealand is a small country — the latest census figure shows the population as less than one and three-quarter million—and we are conscious that we can claim few world famous musicians. However, New Zealanders have a healthy interest in music and the standard of performance will allow us to present many New Zealand artists from Radio New Zealand. Then, most visitors to this country find the music of the Maori people, with its strong melodic line, interesting and unusually pleasant to listen to, and some of the Maori mythology is good radio fare. So, the songs and stories of the Maori race will be heard at times from our studios.

Broadcasting in New Zealand is a State function, and the programmes for Radio New Zealand are prepared by the Short Wave Division of the New Zealand Broadcasting Service.

The studios of Radio New Zealand are at 38 The Terrace, Wellington, the capital city of New Zealand. They can be linked with all the medium wave broadcasting stations in New Zealand so that programmes originating in any part of the country may be available to overseas listeners.

The two transmitters used by the Short Wave Division are at Titahi Bay, some 17 miles from Wellington. Each transmitter has a radiated energy of 7½ kw. They employ high level modulation, using 2-889R type valves as class B modulators and 2-889R type valves as the final modulated RF stage. They cover a frequency range of 6 to 22 mc and a change in frequency can be made in less than two minutes.

As the initial programme service is primarily intended for Australia and the Pacific, all the present aerials are designed for a total beam width of 68 degrees. The majority of the aerials consist of two tier, two-bay, .5 wavelength long horizontal radiating elements with reflectors. The earlier aerials have the radiating elements spaced .5 wavelength in the vertical plane while the later slewable beams for the Pacific service are designed with a vertical spacing of .7 wavelength. All radiating elements consist of a three wire centre-fed Kraus structure."

During the test period, Radio New Zealand was also using ZL2 on 9.54 mc but at the opening of their service, they only used ZL3 and ZL4. Other channels assigned to this station are ZL1 on 6.08 mc, ZL5 on 17.77 mc, and ZL6 on 25.8 mc.

VERIFICATIONS OF THE MONTH

YDH2, JAVA.—A very courteous letter of verification was received from Captain M. J. O. Branse, of the Royal Netherland Army, who is chief of the Radio Welfare in Semerang. He advised that YDH on 2.51 mc and YDH2 on 11.03 mc are purely amateur built and intended for the Dutch and native forces. Their operating times are from 1.0 pm to 3.0 pm and 7.0 pm to 1.0 am daily, with programmes in Dutch, Malay and Javanese languages.

The address shown at the top of the letter is Koninklijk Nederlandsch Indisch Leger, Koninklijke Landmacht, Bijkantoor Dienst Welfare Midden—Java, so a report sent to this address will also produce a verification we imagine.

ITALY.—The English announcer at Radio Italiana, appears to be very attentive to listeners' mail and this lady seems to sign all cards sent out as verifications for reports on the English session. The latest one received at our location shows on the one side a picture of the Colisseum, Rome, that magnificent old ruin which is known to all visitors to Italy.

On the other side of the card are the details of verification showing the date of reception, time, and the frequency of the particular station verified. A few words are added by Miss Perrin which makes the card somewhat more personal than would otherwise be the case.

APK, PAKISTAN.—In last month's issue we reported that Radio Pakistan had been heard on 6.06 mc and we are now pleased to advise that a letter of verification has been received from the station Mr. George Major, of Western Australia, has also received his verification and he is to be congratulated as his was the first report the station had received from Australia.

From our own letter and copy of the one received by Mr. Major we learn that the station's call letters are APK, but they state "we identify the station every now and then by actually announcing the frequency and name of the station." As this is a new country we give a few further details which may be of interest

Daily programme schedule is: Noon to 2.0 pm, 5.0 pm to 6.30 pm, 10,0 pm to 3.30 am. News in English is at 12.30 pm to 12.45 pm, 6.0 pm to 6.10 pm, 10.30 pm to 12.40 pm, and 1.30 to 1.45 am. The present transmitter is an experimental one of 250 watts

This Month's New Stations

CHINA.—As we have remarked before, Chinese stations are always rather difficult to follow as even though one correctly identifies the call letters, the location is not always so clear. In addition to this, the modulation is very often poor which does not help matters.

A new station which, however, can be identified as to its call, is XNNR which has been heard at good strength on 7.09 mc around 10.0 pm. So far, we do not know the location of this new one, but hope to have word of it for next issue We have also had reports of XGSW being heard on 21.45 mc late at night. This station is another of the Nanking stations which have recently come on the air.

CUBA.—A few years ago, the Cuban stations were all heard at very good strength in Australia, but it now seems the exception rather than the rule to hear any of them at anything like good strength. It is always interesting therefore, when a new one comes along as one always hopes that it may be an improvement on the others.

We do have one new one to report this month in COBA which has been heard on two occasions on 9.965 mc around 7.0 am. On the hour they gave two calls the first being a CM one and the second CO, signifying the broadcast band call and the short wave call. We have to thank the Universalite for giving us the exact call letters as beyond it being a Cuban, we could not catch the full call. Possibly it was only testing, as we have not heard it since.

AUSTRALIA.—We have a new station this month from our Radio Australia or more correctly, it is a new frequency for one of the old ones. As from 2nd October, VLC8 began a new transmission on 1.24 mc starting at 3.0 am. Readers will remember that VLC8 used to use the 7.28 mc channel. This new programme is in German and is intended for reception in Europe and will carry actuality broadcasts from displaced persons who are now resident in Australia.

These new broadcasts are intended to convey to people in Europe the feelings of those who have now made this country their home. The time is a little inconvenient for Eastern Australia listeners but perhaps one weekend you can stay up long enough to log the new VLC8.

BRAZIL.—Mention was made last month of the new Brazilian stations operating in Recife, Pernambuco. We have now had a report of one of these stations being heard, ZYK2 on 15.145 mc which was logged one night just after 10.0 pm when YDC happened to be off the air for a few minutes. Strength was weak but the announcement was heard sufficiently well to identify the station.

According to Universalite, the announcement from this station which is, of course, in Portuguese is "Pernambuco flando para o mundo ostas sao as emisoras de Radio Jornal de Comercio." We have an idea that ZYK3 on 9.565 mc is also audible in the mornings around 7.0 am as we are hearing a station which sounds very like it but call has not been definitely identified.

HONDURAS.—This is one of the countries that all listeners who go after the Latin Americans are always trying to log and we now have a very much better chance to do so as HRA which used to operate on 6.048 mc has now moved to a much more favorable channel in 9.045 mc where it has now been heard around 11.0 pm.

On the hour the station slogan is given "La Voz de Lempira" and also the location which is Tegucigalpa. Unfortunately we do not have the full address of this interesting station, but should imagine if a report is sent addressed as above it should reach its destination all right and we hope in time to bring forth a very desirable verification.

STATIONS IN ASIA NOW HEARD

The stations in Asia are possibly among the best heard in this country though admittedly many of them are not of particular interest due to the fact that a large number do not use English. However, from a point of view of stations audible there is no scarcity of them and they can be found at all times of the day and night on all bands from around 3 mc right up to 21 mc.

We show below a summary of some of the best heard at the present time and we feel sure that all listeners will be able to log them if they have not already done so. Many more are of course audible and others appear from time to time.

PHILIPPINE ISLANDS.—Always the best heard of the Philippine stations is KZRH on 9.64 mc which puts in a very good signal both in the morning and also in their night programme. The loudest we have ever heard them is around 6.45 am when they play records as a test before coming on the air at 7.0 am with their daily programme.

A sister station of KZRH is KZMB on 6 mc which is known as "The Voice of Manila" and is operated by the same company, the Manila Broadcasting Company. Two other well known Manila stations are KZPI on 9.5 mc and KZOK on 9.69 mc both of which are owned by the Philippine Broadcasting Corporation The first mentioned is by far the best and toward 10.0 pm comes in nicely.

Still another Manila station is that known as "The Peoples Station" and which has the call sign KZFM. They transmit on 6.17 mc, 9.62 mc and 11.84 mc, but all of these channels suffer from interference on most nights. Last but not least of the Manila transmitters are those used to relay the Voice of the United States of America and which operates on 11.89 mc and also 15.33 mc.

In the city of Cebu there are two stations both of which can be heard at night at quite good strength. The first of these is KZRC which operates on 6.14 mc and the other KZBU which uses a channel of 6.1 mc. This latter station is also operated by the Philippines Broadcasting Corporation.

INDIA.—This country needs no introduction to short wave listeners as its stations have been heard by all at one time or another. They have a very large number of outlets and Delhi alone has nine short wave transmitters all of which use different frequencies at various times of the day and night.

One of the best heard in the day time is 21.51 mc which is really fine and it can also be logged until late at night. Other good outlets are on 17.83 mc, 15.16 mc, 15.19 mc, 15.29 mc, 15.35 mc, 11.85 mc, 9.59 mc, 9.63 mc, 9.67 mc, not to mention those in the 61 metre band. In addition to Delhi, we also have the transmitters operating from Madras, Calcutta and Bombay, all of which come in well.

INDONESIA.—It is hard to know where to start with these stations as there are so many of them now on the air. Possibly the best heard just now is YDC in Batavia, which uses 15.15 mc and which is heard well at 9.0 am and also around the same hour at night. PLB4 on 10.365 mc is another good one and YHN on 10.84 mc which is located in Djokjakarta is always at good strength nightly.

Semarang comes in nicely over YDH2 on 11.03 mc, and the well known Radio Macassar can be heard both on YFA 5.06 mc and YFA9 on 9.37 mc. Other channels which are heard every night are YDD2 on 4.87 mc, PLD6 on 17.63 mc, YDP on 4.845 mc and Biak on 4.895 kc though the latter is usually very noisy.

FRENCH INDO-CHINA.—Radio Saigon is a station that has been heard in Australia for many years now and strangely enough it is not nearly as loud now as it was before the war. The 11.78 mc outlet can however, be heard quite well every night and when the static is not too bad, the other channel of 6.165 kc also comes in nicely.

Another Indo-China station which caused quite some comment when it first came on the air is Radio France located in Hanoi. They were first heard at the top end of the 31 metre band and then moved to 6.048 mc but latterly they seem to have settled on 6.19 mc where they can usually be heard till closing at 10.0 pm. There have been a few others at various times, but they are inaudible now.

JAPAN.—The BCOF station located at Kure has become quite a regular now and can be heard any night operating on a frequency of 6.105 mc using the call WLKS. They relay quite a number of the Radio Australia programmes. Two other Japanese stations which come in well are JKE on 4.86 mc and JKD on 6.015 mc. These stations are operated by the Armed Forces Radio Service for the benefit of the American troops in the Far East.

The purely Japanese stations such as JKF on 4.91 mc, JKC on 7.257 mc, JVW on 15.225 mc, and JVW3 on 15.235 mc can also be heard at various times while around 7.0 pm we have often heard JKE on 9.605 kc relaying the programmes from WVTR. Others which are audible are JVW2 on 9.505 mc and JVW4 on 9.56 mc.

CEYLON.—The Forces Broadcasting Station in Colombo or as it is more popularly known, Radio SEAC, provides some quite interesting programmes and they can usually be logged on one or more of their various frequencies. The latest schedule we have for this station gives their times on the air as follows: 2.30 pm to 4.30 pm, and 8.30 pm to 12.15 am on 15.12 mc while the second transmission is at the same times on 3.395 mc, 9.52 mc, 6.075 mc, and 17.73 mc.

On Saturdays and Sundays both transmissions start four hours earlier at 10.30 pm. The special transmission for the United Kingdom is from 1.30 am to 4.30 am over all the above frequencies. Other channels not heard often are 7.185 mc and 11.77 mc.

MISCELLANEOUS.—Other stations in Asia which can always be heard in Australia are Rangoon on 6.035 mc using a power of 7½ kw, ZBW3 in Hongkong on 9.525 mc with their usual poorly modulated signal, HLKA on 7.93 mc operating from Seoul in Korea, HS8PD, Bangkok, on 5.995 kc with their English session just after 9.0 pm, Radio Baghdad on 7.09 mc with their purely native type programme in the early hours, and Beyrouth in Lebanon, on 8.036 mc also in the early morning.

The Syrian station in Damascus can be heard on both 6 mc and 12 mc around 6.0 am and also at 1.0 am while there is also the Forces Station in Cyprus which transmits until 6.0 am on 7.22 mc and which we reported in last month's issue.

NEW STATION LOGGINGS

Call	KC	Metres	Location	Time Heard
XNNR	7090	42.31	China	10.00 pm
VLC8	7240	41.44	Shepparton, Vic.	3.00 am
HRA	9045	33.18	Tegucigalpa, Honduras	11.00 pm
COBA	9965	30.11	Havana, Cuba	7.00 am
ZYK2	15,145	19.81	Recife, Brazil	10.15 pm

SHORT Wave Notes for the December issue are due on 6th November. In the January issue they are due on December 13. Please send them direct to Mr. Ray Simpson, 80 Wilga Street, Concord West, N.S.W.

FLASHES FROM EVERYWHERE

SWEDEN.—Although the DX sessions from the Swedish short wave stations have never been heard at any great strength in this country they have been of interest to quite a number of listeners. In the latest issue of the Swedish DX bulletin we learn that as from the 9th October the "Seden Calling DX-ers" will be as follows: 1st transmission opens at 5.15 pm on SBO 6.065 mc and SBU on 9.535 mc. The 2nd transmission is at 1.0 am on SDB2 10.78 mc and SBT 15.155 mc while the 3rd transmisison is at 11.0 am on SBO 6.065 mc and SBU 9.535 mc. Reports on any of these transmissions are welcomed and should be addressed to The DX Editor, Radiotjanst, Swedish Broadcasting Organisation, Stockholm, Sweden.

COLOMBIA.—A few years ago it was not unusual to log quite a number of the Colombian stations on the 30 and 31 metre bands during the early afternoon. Most of these transmissions were harmonics of their outlets in the 4 mc band, but came in at surprisingly good level. However, we now have one or two of them who are actually transmitting in the 9 mc band and the latest of these is HJKP which is located in the capital, Bogota, and has the slogan "Emissora Nueva Mundo de Bogota."

They are using a frequency of 9.52 mc and have been heard in Europe from around 8.30 am and also up till about 1.30 pm. This is rather a crowded part of the dial, but you may be able to hear this new one on a favorable occasion.

BRAZIL.—Two Brazilian stations which were often heard at fair strength in the years before the war, PSH on 10.22 mc and PSF on 14.69 mc have again been logged both in the USA and also in Australia. In the States they have been heard until closing at 9.0 am with the Brazilian National Anthem, "Ouviram do Iparanga."

Their programmes consist of various Press releases from the Brazilian Government such as "Noticias Federal," "Noticias de Capital" and "Noticias de Interior." All these transmissions are in Portuguese but as it sounds very similar to Spanish you should be able to understand some of their programmes. These stations used to send out a very attractive verification card.

MISCELLANEOUS.—Our regular and valued correspondent in Brisbane, Mr. Ern Moore, tells us that he is hearing Baden Baden very well on 6.32 mc until sign off at 6.0 am. The Brazilians PRL7 on 9.72 mc was heard well around 6.0 am with sports commentary in Portuguese while ZYC8 on 9.615 mc was also heard at 6.30 am. At night, ZYC9 on 15.37 mc could be copied from just after 9.0 pm but suffered from severe morse interference.

Ern also heard the new Danish station on 9.52 mc announce that they would commence regular transmissions on 1st October and on that date the King of Denmark would broadcast. From the 2nd October this station will transmit a programme for Danes in the USA and Canada from 10.0 am to 11.30 am.

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1 s[illegible] x 5/16 Whit. Spanner. 1 steel ⅜ x 5/16 Whit. Spanner, 1 steel ½ x 7/16 Whit. Spanner, 1 steel 1/16 x ⅜ SAE Spanner, 1 steel 15/16 x 1" SAE Spanner, Ring and open end Spanner, 7/16 SAE, 1 Ring and open end Spanner, ½" SAE, 1 Ring and open end Spanner, 9/16 SAE, 1 Ring and open end Spanner, ⅜ SAE, 1 Magneto Spanner, 2BA x 4BA, 1 socket spanner, ⅜ without handle, 1 Ball Pein Hammer, 1½lb. 1 pair Pliers, 1 Metal Toolbox, 3¾" wide x 7" deep x 15" long.

The Lot £3/5/6

Free on Rail Sydney.

Please state your nearest attended Railway Station.

STIRRUP PUMPS

Brand New American Stirrup Pumps, original cost 27/6. These are in perfect condition.

OUT THEY GO.
EACH **5/6**

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Postage, N.S.W., 2/-; Interstate, 3/6.

P.M.G. ADJUSTABLE MORSE KEYS

Genuine P.M.G. Morse Keys with adjustable buzzer, complete with HEADPHONES, brand spanking new.

Cost the Army £4/10/-.
Our Price, the two **15/-**

Without batteries which are easily obtained at any electrical store.

Postage, N.S.W., 1/6; Interstate, 2/6.

FORKS AND SPOONS

SOLID NICKEL SILVER, ENGLISH MADE

SPOONS, Dessert, 2/- ea. Soup, 2/- ea. Tea, 1/3 ea.
FORKS, Dessert, 2/- ea. Table, 2/9 ea. Add postage.

Carpenters' Claw Hammers

Ex-Army. Brand New. 24oz.

Each **5/11**

Postage, N.S.W., 1/3; Interstate, 2/-.

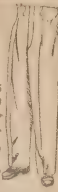
Serge Army TUNICS

BRAND NEW KHAKI

Woollen Serge, S.D. TUNICS. Sizes 4 and 5 only. Unbeatable for warmth and hard wear.
ONLY, each **11/6**

Postage, N.S.W., 1/3; Interstate, 2/-.

Jungle Green Trousers



BRAND NEW

The best work trousers it's possible to get, as any of the boys from Army will tell you. Worth 30/- a pair. All sizes.

PRICE **17/6**
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JUNGLE GREEN SHIRTS

We have just landed a huge purchase of these jungle green shirts and will never again be able to sell this exceptional quality shirt at this price. 27/6 value.

OS and XOS **12/6**
Post, N.S.W., 9d. Interstate, 1/3.

Army Slouch Hats Brand New

Genuine Fur Felt. All sizes. The hat for all purposes. Complete with chin strap, ea. **7/11**
Please state size. Postage N.S.W., 1/-. Interstate, 1/6.

MOSQUITO NETS

Ex-Army. Green. Brand New. Originally cost the Army 35/-.
Postage 2/- extra. **14/6**

FOUNTAIN PENS

Good English make, brand new, while they last .. ..
POST FREE. **6/- ea.**

SHOES

Best quality white canvas shoes, made in England, leather soles; ex-Royal Navy; brand new. Sizes 8 and 9 only. Worth 42/- pair. OUR PRICE 15/11

American Mosquito Proof Hammocks

BRAND NEW

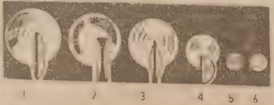
Easy access with zip fastener. Strongly made, complete with ropes, etc. Worth every penny of £8/10/-. Our special price, 37/6 each. Post N.S.W., 2/-. Interstate, 3/6.

REFLECTOR GUNSIGHTS

Ex-Air Force. Containing best quality condenser lenses and adjustable reflector. Parts can be used for many purposes.

39/6 ea.

Postage 2/6 extra.
COMPONENTS INCLUDE THESE VALUABLE LENSES



No. 1 Diam. 3 5-8 Foc. Len. 10in. No. 2 Diam. 3¾ Hollow Ground. No. 3 Diam. 3¼ Foc. Length 4½in. + No. 4 Diam. 2 3-8 Foc. Length 6½in. + No. 5 Diam. 1 1-8 No. 6 Diam. 1 1-18 Amber Coloured ordinary.

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ZERC PUSH-TYPE GREASE GUNS, EX-ARMY.
3oz., slightly used, perfect order .. 9/6 each
10oz., slightly used, perfect order .. 15/- each
Postage 1/6 extra.

Extra Special Wet Weather Offer

Brand new RAINCOAT, Army anti-gas; 1 brand new sou'wester; 1 pair brand new waterproof Gauntlets.

The Lot For 11/-

Postage, N.S.W., 1/6; Interstate, 2/6.

Black Oilskin SOU-WESTERS

ALL SIZES.

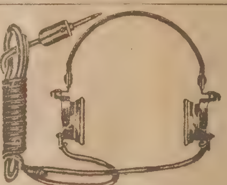
Ex-Navy. Brand new, original price, 13/6. These are super quality. Out they go.
EACH **3/6**
Post 6d. N.S.W.; Interstate, 9d.

Machete Bush Knife

Brand new. Best quality tempered steel, approx. 15 inches long. Ideal for scrub cutting, butchering and general utility knife.
PRICE **6/6**
Sheaf 1/- extra. Post 1/- extra.

Haversack Bargain

They are water-marked and soiled, but only need a scrub to be as good as new. Suitable for School Bags, Fishing, Hiking, Bicycle, Tool Bags, etc. THE BARGAIN OF THE DAY. Complete with Strap **1/3**
POST 6d.



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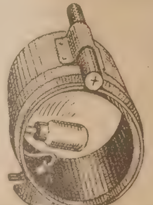
Brand new, S.T.C. and Stromberg- Carlson. We have just made another purchase of these brand new 'phones, complete with cord and plug, and we are now able to sell them at the ridiculously low figure—130 ohms impedance **9/6**
Postage 1/6 extra.

2000 ohms impedance **£1**
Suitable for crystal sets.

PLEASE NOTE: These 'phones are brand new, ex-Army, and not military rejects.

SPOT LIGHT



Ideal for fishing, hunting, shooting. Brand new. Original cost £2/15/-. Our price, complete with stand,

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THE HAM BANDS WITH BILL MOORE

The amateur world is still getting used to the fact that it has lost its key man in K. B. Warner of the A.R.R.L. If no man is indispensable, Warner came as near to being just that in the vast organisation he did most to create. It would be difficult to overestimate the value of his work.

AS briefly mentioned last month, amateur radio lost one of her foremost pioneers in the sudden passing on September 2 of Kenneth B. Warner, WIEH for nearly thirty years secretary and general manager of the ARRL, a brilliant leader and possibly the truest and most ardent worker for amateur radio in the world. As QST states, "The man who perhaps more than any single amateur, left his mark in the history of amateur radio."

Kenneth Warner, or perhaps, better known by his personal sign, KBW on QST editorials, wrote much enlightening matter on our work but little about himself. Tracing his history as secretary of the ARRL as a result is a difficult task. Perhaps it is the sign of his character that he was able to guide a wide organisation and a famous technical radio magazine for so long, without forcing his own personality throughout his writings.

His guiding hand could be seen in the growth of the International Amateur Radio Union of which he was also secretary—where all national societies are equal, whether it be the Society of Iceland with 15 members or the ARRL with 67,000.

To trace WIEH and his original connection with the ARRL we must go back to 1918 just after World War I. The end of amateur radio in the US was in sight. Congress was enacting a bill that would stifle the hobby for all time. Hiram Maxim, prewar president of the ARRL, rushed to Washington, argued and pleaded and the bill was defeated. Maxim immediately called a meeting of all the old directors he could find, 11 in number, who themselves financed the sending of a notice to all prewar amateurs they could locate and hired Kenneth B. Warner as the first paid secretary of the ARRL.

The rest is history, with WIEH as secretary of an organisation of worldwide repute. The League can be considered the greatest single factor contributing to the welfare of the amateur today.

Like any other person in similar authority he had his critics, but if success is any criterion, they should be silenced for all time.

KBW's death was even sadder as it was on the eve of the Fifth ARRL National Convention held Milwaukee on September 4, 5 and 6. It was the first National Convention post-war and he was scheduled to speak on a subject in which he was so well versed, and one so dear to him, "Your organisation, the ARRL."

We have lost an illustrious member of our fraternity.

DX CONTEST PRIZES

THE contest manager, E. H. Jenkins, VK3QK, announces the prizes for Australian competitors in the 1948 VK/ZL DX contest run last month.

The following is the list of prizes to be awarded. In parentheses after each prize is the name of the firm who has so kindly donated the equipment. Open Telephony Section: 1st prize—100 watt Modulation Transformer TA908 (Trimax Transformers, Melb.). 2nd prize—open order for £5 of Eddystone components (Keith Harris and Co., Melb.).

Open CW section: 1st prize—complete complement of valves for 5-inch oscillograph, comprising 1-5U4G, 2-6J7G, 2-6SN7GT, 1-6V6GT, 1-AV11, 1-884 and 1-5BP1 (Amalgamated Wireless Valve Co.). 2nd prize—2 transmitting valves (Philips Electrical Industries).

28mc Telephony Section: N.B.F.M. Adaptor (Kingsley Radio, Melb.).

28mc CW Section: 815 valve (Prices Radio, Sydney).

14mc Telephony Section: 50 watt modulation transformer (Ferguson's Radio, Sydney).

14mc CW Section: Order for £5 value transformers, chokes, &c. (Red Line Equipment, Melb.).

7mc Section: Complete AT5 transmitter (Ham Radio Supplies, Richmond, Vic.).

3.5mc Section: Extension speaker with adaptor (Kingsley Radio, Melb.).

Receiving Section: 1st prize—Foundation kit for Ferrotune B.C. set (Kingsley Radio, Melb.). 2nd prize—0-1 mill. meter with multi-meter scale (Veall's Radio, Melb.).

AMATEUR CONTROL

MENTIONED in a recent issue was the fact that the ARRL was encouraging the establishment of a form of self policing of amateur bands similar to our advisory committees. The SARL National Society of South Africa has also a similar project under way.

Under authority delegated by the Postmaster General the SARL has established an official observer service, to maintain a careful check on the operation of amateur radio stations in that country. Although the service is operated under due authority, it is instituted and conducted by self-policing for the good of amateur radio. The chairman of the observer committee on behalf of the council of the SARL will appoint observers from the membership of the League. Such appointments will be normally for one year and may be terminated or renewed at anytime, at the discretion of the council.

These observers, although working on a different system from our advisory committees, serve the same purpose, a degree of control of the amateur by the amateur. The advisory committees set up over ten years ago by the department with the assistance of the WIA in all States are doing a good job.

The individuals acting on these committees are often the brunt of critical comment but we must always remember they are willing to do a job to assist amateur radio and endeavor to keep the isolated purveyors of poor signals from getting out of hand.

W.I.A. NATIONAL FIELD DAY

THE WIA's National Field Day for 1949 is scheduled for January and full rules for the day will appear in December Amateur Radio. These field days provide an opportunity to really try out and test the portable or emergency gear.

It is also an opportunity to try and get the YF interested in amateur radio. Previous experience shows a YF or two are an advantage at a show like this. The knowledge of the culinary art of most amateurs seems limited and if you are operating for 24 hours straight one needs more than liquid refreshment. Build for National Field Day and combine amateur radio with a weekend's outing.

QRRR

QRRR now becomes the official land emergency call designation in lieu of QRR. The latter Q code abbreviation was issued at the recent Telecommunication Conference to cover automatic operation, hence the change. The full definition QRRR—official ARRL land SOS. A distress call for emergency use only by a station in an emergency situation.

W.I.A. NEWS

SEPTEMBER general meeting of the NSW division saw Mr. N. A. Hicks, VK2ANH, display films, exhibit equipment and present an extremely interesting lecture on Industrial Electronic Equipment. The two talkie films, one showing the functioning of valves used in industrial control and the second, their application were very instructive. As a result of a ballot that was conducted throughout the State the following frequencies were recommended for CW use by "gentleman's agreement" only. 3500-3600, 7000-7050, 14000-14150, 28000-28150 kc's. This result will be passed to the Federal Executive as the NSW view on the matter.

UHF NEWS

IN the UHF drive downwards VK2ND portable and old timer VK2RF are working on the 576-585 Mc band contacts have been made, up to distances of a mile.

October meeting of the NSW UHF section was well attended when Messrs. Andrew and Maycock, of AWA, lectured on FM receivers and FM transmitters, respectively. Scheduled for the November meeting is a lecture by Mr. Holloway, of AWA, on UHF receiver technique. These are the first of a six months' series of lectures arranged by Bill Macgowan, VK2MQ.

NSW UHF CONTEST

AFTER two weeks' trial the UHF contest run by the NSW division seems to be doing much towards its main objective, that of populating the UHF bands. Upwards of 15 stations appearing on 50 mc nightly.

Stations some distance from Sydney in the Blue Mountains and Newcastle areas are scoring well, 2ADT, 2BZ, 2LZ and 2LY are very active. A few signs of sporadic E would certainly attract a lot of visitors to 50 mc and make the contest of even greater interest.

RADIO CLUBS

BOTH the Newcastle district and Gladesville district radio clubs have applied to be admitted as member clubs of the NSW division of the W.I.A. The latter club concentrates most of its activity on the UHF's, even to the extent of running UHF demonstrations at meetings. A recent one being conducted by VK2HL and VK2AJR on 288 mc.

Down South the Geelong Amateur Radio Club is progressing rapidly, the club rooms are at 68 Lt. Malop Street, Geelong. Interesting demonstrations of equipment have been given, Father Ryan recently recorded the local crew on a Thursday evening hook up and played back the record at a meeting, much to the enjoyment of all concerned. Secretary Bob Wookley, VK31C, 158 Kilgour Street, Geelong, would be pleased to supply details of club activity.

GET YOUR TICKET

And join the ranks of licensed amateur transmitters. The W.I.A. holds regular classes in theory, practical work, and code. Fully qualified instructors.

Write for particulars to the Amateur's official organisation.

THE WIRELESS INSTITUTE OF AUSTRALIA,
Class Manager, Box 1734, GPO, Sydney.

"S" METER CIRCUITS FOR AMATEURS

(Continued from Page 67 of September Issue)

IT is significant that the valve specified was a 6C5, which has a fairly high amplification factor. In practice the large amount of resistance in the cathode circuit produces considerable degeneration, and only a high-mu valve can be brought to cut-off by a normal AVC voltage. A general purpose triode like the 6J5 requires a very much larger cathode circuit resistance, and, allowing for the degenerative effect, cannot be brought to cut-off by any likely AVC voltage.

Figure 4 represents a development from circuit 3. The basic difference is that a bucking current is employed to make the meter read forward, so that the "0.1" calibration becomes S1, 0.2 becomes S2, and so on to 0.9. The region above 0.9 corresponds with the cut-off region of the control valve.

As before, the bucking current is best picked up from the back-bias circuit or from a 50 ohm resistor especially installed for the purpose. To put the circuit into operation, measure the back-bias voltage available and install a series resistor to the meter, such that the current will be slightly greater than one milliamp. Thus, with four volts available, the resistor will be between 3500 and 4000 ohms, while something between 12000 and 15000 would suit if the back-bias voltage is 16.

ADJUSTMENT

Short the aerial terminal of the receiver and adjust the cathode circuit of the control valve until the meter reads exactly zero. The cathode current will decrease with signal, causing the meter to read forward by a corresponding amount. As in the case of circuit 3, a high-mu triode valve is desirable, a good choice being a 6Q7 or 6B6-G. If the metter cannot be brought back to zero by adjustment of the cathode circuit, it is permissible to return the plate of the valve to a point of higher potential, even to the first filter condenser.

CONTROL BIAS

The controlling bias is preferably derived from the detector diode load, so that the deflection on weak signals will not be unduly influenced by delay voltage. The circuit is made completely flexible if the bias is picked up from a potentiometer connected across the diode load. It is then possible to adjust this potentiometer so that the meter reads S9 on a signal which you consider to warrant that report. This control would normally be mounted at any convenient point on the chassis and not touched after the initial adjustment is made. The cathode potentiometer, as in all other bucking circuits, is best mounted on the panel near the meter and arranged for screwdriver adjustment.

In practice this circuit has proved very satisfactory both in its response to weak signals and in the fact that, once set, the meter cannot be overloaded by more than a few per cent.

ECONOMY FIVE

(Continued from Page 51)

If you use the same transformer as in the original set, you will find that the high tension voltage approximates 90, the current averaging about 16 milliamps with signal. This is a trifle higher than the designed maximum for the transformer, but it showed no signs of distress.

As we stated earlier, the total load current from the 6.0 volt battery is almost exactly 0.7 amp.

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OK, DELL, IT'S A DEAL
SIX MONTHS LATER
HERE IS MY DIPLOMA SIR AND I HAVE MORE BUSINESS THAN I CAN HANDLE ALREADY
GOOD BOY!
POP SAYS WE CAN GET MARRIED
OH! JACK, ISN'T IT WONDERFUL?

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R & H Nov. '48

GOOD MONEY • INDEPENDENCE • TRAVEL

GETTING STARTED WITH F.M.

(Continued from Page 57)

noise reducing characteristic, but poorer regulation.

Where only a single limiter stage is used it is thus necessary and usual to choose a compromise set of constants, opinions varying as to which compromise is best. More expensive receivers, on the other hand, are often fitted with two limiters, the first having a short time constant and the second a much longer one, so that the discriminator is provided with a well regulated signal substantially free from amplitude variation.

A review of current American FM receiver designs reveals a diversity of circuit arrangements and valve types in the limiter stages, but it is not necessary to examine them in detail at this juncture. The main point is to understand the necessity for limiter stages ahead of the Foster-Seeley discriminator and the general means by which limiting is achieved.

It will be apparent from the operating conditions that a limiter stage will not give anything like the gain that the same valve would provide if operated under normal conditions. Not only is its transconductance much reduced by the low plate and screen voltage, but plate current excursions are limited anyway as an essential part of its operation. Thus, the IF channel must include normal IF stages ahead of the limiter, thereby increasing the number of valves in the receiver and problems of stability in the IF channel.

All this would be a very potent argument in favor of the ratio detector were it not for the fact that the ratio detector delivers considerably less audio for a given RF input than the Foster-Seeley circuit. In the aggregate the overall gain for a given number of valves is not very different—the additional resolution of the Foster-Seeley discriminator making up in part for the loss of gain in the limiter stage. What difference there is does favor the ratio detector.

PRINTED CIRCUITS

A SILVERING process which is applicable to many kinds of insulating materials, including plastics such as polystyrene and polyethylene, has been developed by Ward, Blenkinsop and Co. Ltd., 6 Henrietta Place, London W.1.

The colloids employed are known as Elargols and contain a very high percentage of pure silver. They are available as liquids, pastes or powders and application is by printing, brushing or spraying.

The printing process has been developed with particular regard to its use in the production of radio apparatus.

Novel Vibrator Supply

(Continued from Page 61).

pin, and to one side of the 6.3 volts transformer winding. The other side of the same winding is earthed.

For a-c operation a dummy plug is required with a shorting link between pins 1 and 4. When this is plugged into the power socket the heater circuit is completed and the amplifier operates normally. Obviously, the amplifier must never be switched on for a-c operation without this shorting plug in position, as otherwise there will be no drain on the high tension power supply.

For vibrator operation the power plug is wired as shown. The six-volts from the battery is applied to the heater circuit, but not across the winding of the power transformer. B-minus goes straight to chassis, while B-plus is applied to the rectifier filament pin. It passes through the filter and is applied to the high tension line in the usual way.

The power socket on the amplifier can still be used, of course, to supply a radio tuner or any other auxiliary device while the amplifier is operating on a-c power.

The necessary plug would lead off the 6.3 volts for the external heater circuit and carry also a shorting link between pins 1 and 4. High tension is available, either filtered or unfiltered, while B-minus connects back to chassis via pin 6.

All these modes of operation have been tested with complete success.

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Wound on Trolitul Formers, moisture proofed for tropical conditions.
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50 mmf silver mica condenser moulded in base, welded condenser joints cannot come loose.

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PT42 2nd stage
PT43 Low Gain
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OFF THE RECORD — NEWS & REVIEWS

I think the "Symphonic Variations" will be the most popular local release this month. This recording may not have the subtelty or graciousness of some others, but it is nevertheless a fine one.

By JOHN MOYLE

EILEEN JOYCE (Piano) with L'Orchestre De La Societe Du Conservatoire De Paris, cond. by Charles Munch—Symphonic Variations. Cesar Franck. DECCA Z.921/2.

This is possibly Cesar Franck's best-known work, and is well up in the list of standard concert pieces. Personally I never tire of hearing it despite the fact that I have heard it more often than I could count.

It is typical of the composer, not only in style, but in mood. Franck was largely a "stained-glass-window" composer, unashamedly romantic, a writer of sweetly expressive melodies and strongly romantic background. His was the music of another world—there isn't a harsh note in all of it. There is, however, plenty of animation and a texture that I at least can take with great ease.

This work is well suited to a woman's touch. Eileen Joyce gives a really good all-round performance—technically impeccable, although, if anything, a shade too heavily underlined. Franck does not take altogether kindly to her full set of dynamics, but don't let this remark dissuade you.

The surface isn't as clean as I would have liked, but general balance is very good, coupled with a nice reverberation in recording. There is undeniably some very beautiful playing, particularly in the exquisite Adagio "movement."

MINNEAPOLIS SYMPHONY ORCHESTRA (Conducted by Dimitri Mitropoulos), Symphony No. 2 in C Major, Op. 61 (Schumann). COLUMBIA LOX.778/82.

I must admit right away that I have never been able to enthuse over the larger works of Schumann. I will not deny that they contain some fine passages, but, in the main, they cannot stand comparison with his songs and piano pieces.

I always have the impression of a man desperately and sincerely striving to create something big, only to see his efforts fall about his ears. There are transitions which are as inexplicable as they are ineffectual—there are whole passages which flow past with very little impact, meaning, or distinction. I would go so far as to call them banal.

Here we have an orchestra and conductor who have succeeded admirably in making this symphony sound as convincing as I imagine it ever will sound. My first impression was that the recording chamber was too small and dead, but the work is also small in scope, and simple in its orchestration. Overall effect is, therefore, quite pleasant, and allows some good instrument definition, the more acceptable because of the high orchestral standard.

I think the second and last movements show at once Schumann's success and failure. The second is quite a thing of beauty—the last in common with most Schumann "lasts," is a rowdy unmusical hotch-potch. As I have said, the recording is quite a good one, and the pressing adequate.

KATHLEEN LONG (Piano) with National Symphony Orchestra, conducted by Boyd Neel—Concerto for Piano in B Flat (Mozart). DECCA Z.917/19.

I pass this recording with almost full marks. It is just what one would hope to find from reading the label—distinguished playing of a delightful concerto by artists who know exactly what to do and how to do it.

Kathleen Long specialises in these Mozart works, but from memory I can't remember a better example than we have here.

Technically it is above average, even though an odd note of the piano tends to peak near the centre of the records.

The quality of string and woodwind is delightfully clear. The piano, too, comes through with credit.

I can commend these records with confidence.

THE LONDON SYMPHONY ORCHESTRA (conducted by Muir Mathieson)—Incidental Music from the film The Overlanders. DECCA Z.905.

There is a distinct F.F.R.R. sound about this record which has a fine sense of weight coupled with clarity. Those of you who like your film music will get really good value. It will probably show up best on a good pickup. General orchestral balance is of high standard, with the woodwind particularly well heard.

I sometimes wonder whether this type of film music can hope to "stand up" without the film to which, after all, it is only a support. The case isn't the same for the Warsaw Concerto, for instance. In this record, there is little to hold it together.

DEREK BARSHAM, Boy Soprano, **GLADYS PALMER**, Contralto, and **NORMAN LUMSDEN**, Bass, with London Symphony Orchestra—Boris Godounov—Nursery Scene. DECCA Z.923.

Notable particularly for a fine boy soprano of quite unusual quality and intelligence. The recording, too, is a good one; the boy's voice is heard with great realism. The surface is quite clean with the average crystal pickup, although needle wear will show up on some of the higher vocal notes.

Dramatically it is quite good, without being outstanding. Somehow I always react unfavorably to English translations. It is difficult to avoid an anti-climax in a language with which one is familiar.

VLADIMIR HOROWITZ (Piano), Mendelssohn's Wedding March and Variations After Liszt (two parts). H.M.V. ED.802.

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RH/11.

An incredible piece of piano playing by one of the greatest pianists living. That being so, I am filled with wonder that he bothers with such terribly poor stuff.

EILEEN JOYCE (Piano) with the National Symphony Orchestra and Male Chorus, cond. by Muir Mathieson—Baraza. DECCA Z.920.

This is another of those "film music" records which again I just couldn't get around, as it for me doesn't seem to have any starting or focal point and, therefore, any reason for being. I, therefore, feel too handicapped to make any worthwhile comment.

JASCHA HEIFETZ (with Piano acc. by Amanuel Bay)—Gavottes I and II and Folk Dance. H.M.V. EC.176.

Clearly played music, pleasant but not weighty. Rather slight music for such a giant.

Other Releases of the Month Include:

COLUMBIA

DORIS DAY & BUDDY CLARK WITH ORCH.—Confess and Love Somebody. DO.3191.

BILL JOHNSON WITH ORCHESTRA.—Glen Echo and Pals of the Lonesome Trail. DO.3192.

VICTOR SILVESTER & HIS BALLROOM ORCHESTRA.—Love Is My Reason and I Love The Moon. DO.3193.

FRANK SINATRA WITH ORCHESTRA. But Beautiful and I Went Down To Virginia. DO.3194.

DINAH SHORE WITH ORCHESTRA.—All My Love and I'll Always Be In Love With You. DO.3195.

THE RADIO REVELLERS.—Can You Look Me In The Eyes (And Say We're Thru) and The Shoemaker's Serenade. DO.3196.

ANDRE KOSTELANETZ & HIS ORCH. Lover and Slaughter on Tenth Avenue. DOX.975.

JOHN McHUGH, Tenor with Orch.—My Life Is Yours and My Love Is Only For You. DO.3175.

H.M.V.

LARRY GREEN & HIS ORCH.—The Old Ferris Wheel and Like a Leaf in the Wind. EA.3754.

ARTIE SHAW & HIS ORCH.—Things Are Looking Up and These Foolish Things. EA.3755.

JOE LOSS AND HIS ORCHESTRA.—Giuseppi's Band and Love Is My Reason (Jack Payne & His Orchestra). EA.3756.

FREDDY MARTIN & HIS ORCHESTRA.—All My Love and Why Does It Have To Rain On Sunday. EA.3757.

PERRY COMO WITH ORCHESTRA.—I've Got A Feeling I'm Falling and Body and Soul. EA.3758.

RUSS CASE & HIS ORCH.—Great Day and Sometimes I'm Happy. EB.549.

PATRICE MUNSEL, Soprano, with Victor Orchestra, conducted by Sylvan Levin. Mignon—Polonaise: Je Suus Titania and Le Coq D'Or—Salut A Toi, Soleil. EB.550.

ALLAN JONES, Tenor, with Orchestra. What Is This Thing Called Love and Rosalie. EB.551.

PETER DAWSON, Baritone, with Male Quartet and Orchestra.—Snowbird and By The Side of the Road. EA.3737.

PARLOPHONE

DIZZIE GILLESPIE & HIS ORCH.—One Bass Hit (No. 2) and Oop Bop Sh'-bam. A.7691.

FRANKIE TRUMBAUER & HIS ORCHESTRA.—Hot Jazz Classics, No. 29, There'll Come a Time and Mississippi Mud (vocal chorus by Bing Crosby and Frankie Trumbauer). A.7692.

DUKE ELLINGTON & HIS ORCH.—Riding On A Blue Note and Magenta Haze. A.7693.

DECCA

ETHEL SMITH.—Easter Parade and A Pretty Girl Is Like A Melody. Y.6113.

REGAL ZONOPHONE

SLIM DUSTY.—Give Me One More Chance and Sat'day In The Saddle. G.25257.

SMOKY DAWSON.—When I Was A Single Man and The Lights of Cobb and Co. G.25258.

DELIA MURPHY, vocal, with guitar accompaniment by Arthur Darley, Spinning Wheel and Three Lovely Lassies. G.25248.

HANK, The Singing Ranger.—You Broke The Chain That Held Our Hearts and Darling I'll always Love You. G.25249.

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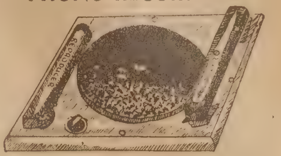

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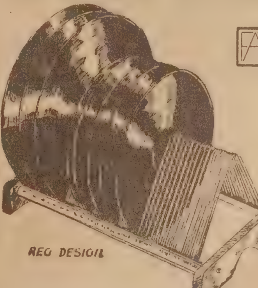

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ANSWERS TO CORRESPONDENTS

M.T.M. (Prairie, Q'ld.) sends in two years' subscription to Radio and Hobbies and suggests that we describe a vibrator powered shortwave receiver.

A.: Thanks for your subscription and we are glad to know also that you had such successful results from the "Vibra-Four" and the "Vibragram-Seven." We note your request for a special shortwave receiver and it is possible that we will bring something like this "out of the bag" in the not too distant future.

A.F. (Toukley, NSW) queries our use of the word "Pulque" (arrow), which is allegedly Spanish.

A.: The particular reference came from the pen of a contributor and we are not in a position to comment on its accuracy. Maybe one of our readers is in a position to supply the Spanish word for arrow or to comment on its use in the Argentine.

[illegible] (Mt. Kuringai, NSW) queries the [illegible] of a copy of April, 1947, issue [illegible]. Also where he may obtain [illegible] and case of the Service [illegible] was featured in that [illegible].

[illegible]-date department is out of stock of copies of R. & H. as far back as that. Copies of back dates beyond a few months are seldom available. The [illegible] regard to metalwork [illegible] with the construction of equipment [illegible] in R. & H. is to pass [illegible] the chassis manufacturers [illegible] the radio trade [illegible]. The chassis and case which you [illegible] should be available through most [illegible] houses, although it may be necessary to first lodge an order for same.

R.C.B (Auburn, NSW) asks about throat microphones and wire recorders.

A.: Although we have had no experience with throat microphones, we understand that they are a carbon type and would therefore be fed into the radio by a conventional carbon microphone circuit involving a transformer and a couple of [illegible] cells. Suitable transformers can be [illegible] up for a few shillings from stores handling disposals equipment. Wire recorders have the advantage that they will handle programmes of longer duration without a break but the Fidelity is generally not so good as from discs, while speed variations in many cases tend to produce "wow." As far as one can judge at the moment they do not present any serious challenge to conventional discs as far as the domestic market is concerned.

D.P. (Caulfield, Vic.) sends in some suggestions and asks a number of questions.

A.: A capacitor leakage tester was described in the June, 1948, issue of Radio and Hobbies. Although a very simple instrument and not able to measure capacitance values, it is very handy for determining the condition of most condensers. A T.R.F. Radiogram was featured in the November issue of last year and data for this set is available through the shilling query service. The dial will track in a T.R.F. receiver as in a superhet provided the dial, gang and coils are meant to work with each other. Plugging an EL3-NG into a 6V6-G socket, without any alterations to the circuit, would have the effect of reducing the current drain and power output, with a slight increase in distortion at room volume. Bypass condensers are placed across the cathode bias resistors for amplifier valves to provide an easy passage for currents at the frequency being amplified. Thus at radio frequencies a 0.1 mfd. condenser offers quite a low reactance while at audio frequencies it requires a capacity of as high as 25 mfd. to provide a negligible reactance. Many thanks for your subscription which has been attended to in the usual manner.

YOUR QUERY?

1. Queries will be answered in rotation through the columns of our magazine if not accompanied by a fee for a postal reply.
2. Queries, neatly and concisely set out, will be answered by mail as quickly as possible if accompanied by 1/- in postal notes or postage stamps. Endorse envelope "Query."
3. Back numbers are rarely available but reprints of most circuits, wiring diagrams, and parts lists will be supplied for 6d each, minimum charge 1/-. Thus a circuit, layout, and parts list will cost 1/6 in stamps or a postal note. Endorse envelope "Circuit."
4. Blueprints of exact size chassis layouts with all essential holes, and cutouts will be supplied if available for 2/6. Endorse envelope "Blueprint."

Address your letters to the Technical Editor, "Radio & Hobbies," Box 2728C, GPO, Sydney.

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A.W.W. (Kangaroo Is., SA) asks for further information about the aerial tuning unit described in the April, 1948, issue.

A.: The exact number of turns on the coupling link and its position with respect to the tuned coil may have to be varied since it is one of the factors governing the loading on the transmitter final tank. However, in the original unit, the link for the 28 and 14mc. coil was wound outside the grid winding—see original illustration, while that for the 7 and 3.5mc, coil could be wound either over the top of the large winding or in a space at its centre.

W.C. (Auckland, NZ) writes in appreciation of recent articles in Radio and Hobbies which enabled both himself and his brother to be provided with excellent amplifier systems. He is particularly impressed with the 807 triode job.

A.: Thanks for your report on the amplifier and it is pleasing to note that the circuit and relevant discussion got your brother out of his difficulties. Also that your own amplifier, on a smaller scale, is providing reproduction as you like it. and, broadly speaking, the class of advertisement included in Radio and Hobbies contains a lot of technical interest. When the paper position improves and production costs diminish, we may be in a position to reconsider the matter.

J.K.L. (Melbourne, Vic.) is interested in building the "Tom Thumb."

A.: Unfortunately, J.K.L., we are unable to comply with your request for a copy of the particular issue, as back issues beyond a few months are not available. However, we have in our files the page showing the chassis photograph. It is a comparatively clear print and should be so in all copies of the issue. Unfortunately, we are unable to forward one of these to you owing to the omission of your address from your letter.

R.A.P.S. (Armidale, NSW) submits for comment the circuit of a crystal set which lacks a tuned circuit. The crystal is simply connected in series with a .001 mfd. condenser between aerial and earth, the phones being wired across the crystal.

A.: We agree that your circuit is certainly a simple one and it operates by virtue of the fact that you have one fairly strong local station. Also the aerial/earth system probably has a natural resonance somewhere in the vicinity of the station's frequency. Such a circuit would be of little use, however, in the average suburban location, since absence of any provision for tuning would make it impossible to select individual stations. The chances are that one would hear either nothing at all or several signals jumbled together.

D.L.C. (Manduring South, Vic.) forwards his remittance for subscription. He also asks a few questions on subjects relating to articles in R. and H.

A.: The subscription department has dealt with your remittance, D.L.C. The power output of an amplifier or modulator could be measured by disconnecting the normal secondary load and wiring across the primary of the output transformer a resistor of the correct plate load and capable of dissipating continuously the maximum power output. A C.R.O. is necessary to pick the region of overload and the power output is then calculated by the well-known formula W equals E squared divided by R. W represents the power output in watts, E the R.M.S. output voltage and R the load resistor in ohms. For a measurement on the secondary it is necesasry to load the secondary winding with a resistor equal in value to the nominal secondary load and capable of dissipating the necessary power. The same formula is used. The ratio of secondary power to primary power is an indication of output transformer efficiency. The frequency characteristic of most rectifier type voltmeters is satisfactory over the normal audio range. Your suggestion of the use of an oscillator emitting a 360 cycle note is quite OK, though output of modulator is more usually measured at a frequency around 1000 cycles. The AVC network shown in the circuit for the 2JU Amateur Five, March, 1947, issue, can be added without difficulty to the Amateur Junior. Regeneration in any stage of a superhet, other than the audio, will bring about increased gain, but introduces the complication of more controls. The plate current of the final valves in an amplifier normally rises with an increase of input signal. The 807 triode amplifier is a notable exception, due to special operating characteristics and to rectified grid current. Pleased to note your satisfaction with the pendulum type clock and your interest in the articles in "The Serviceman Who Tells."

N.R.B. (Malvern, Vic.) suggests that consideration be given to the description of a variable frequency oscillator as suitable exciter for amateur stations.

A.: We agree that the VFO exciter is becoming increasingly popular, although the misuse of such units has caused many a heartburn among the "ham" fraternity. However, we have already given the matter some thought and may, in some future issue, be able to present a unit of worth-while design.

J.A.H. (Gore, New Zealand), suggests a scheme for a compact battery portable receiver. The idea is to have the grid circuit of the converter untuned so that the condenser need only be a two-gang and the R.F. coil would not be required.

A.: We agree that the scheme has certain advantages where compactness is a major consideration. However, we do not think that the idea would find much application in larger sets as the loss in gain would be considerable. The results you have obtained with your set are certainly very encouraging, but the overall gain would be much lower than if the R.F. coil were tuned. The gain of the R.F. amplifier is affected, not the converter.

C.W.C. (Concord, NSW) advises us that he has built up the 2-valve set from the Shortwave Handbook with the addition of a switch and pickup terminals. The combination has proved "highly successful."

A. Your circuit noted. We are very glad to learn that the set has come up to your expectations. We will keep your letter in mind in connection with the "Reader Built It" page.

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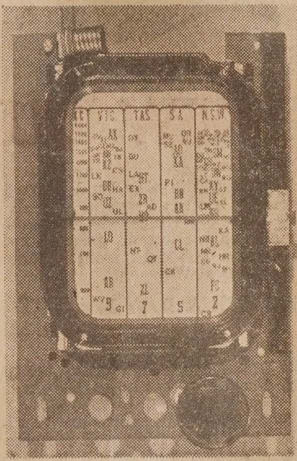

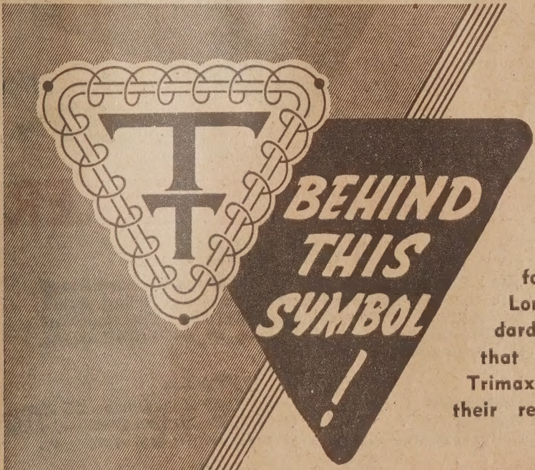
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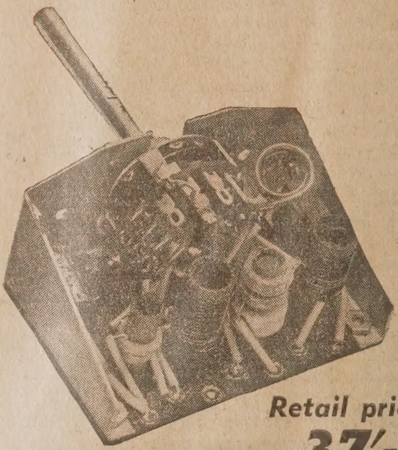

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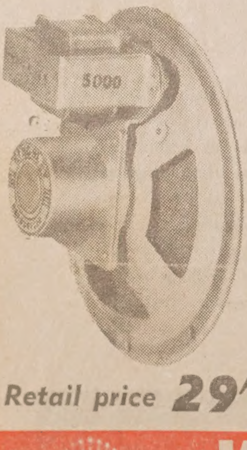

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ANSWERS TO CORRESPONDENTS

T.E.W. (Dubbo, NSW) renews his subscription to Radio and Hobbies and comments generally on our recent articles on fidelity equipment.

A.: We were pleased to note your satisfaction with the articles and trust that you will be able, in the not too distant future, to build up more of the gear. In the meantime, your present set appears to be a very good one. We can recommend the principle of variable selectivity, as in the "Super Tuner," and it should work out very nicely in your location. The residual selectivity is sufficient to bring you the stronger stations cleanly but with a lot more "top" than is normally heard. Yes, the 1603 is a non-microphonic version of the 6C6. However, before purchasing one of these valves we suggest you try mounting the existing 6J7-G on sponge rubber. Thanks for your subscription renewal.

E.T. (Cootamundra, NSW) wishes to know the value of the screen resistor for 6G6-G output valves in the 1946 D/W Standard.

A. It is an involved matter to calculate this value from the valve characteristics and we regret that we have not the time to undertake the task. At a guess we would say that the value would be about 2000 ohms. The most satisfactory way of finding the correct resistor, is by means of an oscilloscope or vacuum tube voltmeter, in an experimental set-up. Again we regret that we cannot help because we do not happen to have a pair of 6G6-G's in our stock of valves. Your suggestion for the description of a 32-volt receiver has been noted.

M.F.C. (Croydon, NSW) says he would like to see a handbook along the lines of the short-wave effort, but devoted to our popular receiver and amplifier circuits.

A. We have something of the sort in mind, M.F.C., but the ever-present problem is lack of time to handle these extra publications.

D.K. (Brisbane, Qld.) renews his subscription to Radio & Hobbies and says how much he appreciates the scope covered by the magazine.

A. Thanks for your subscription, for your encouraging remarks and also for the suggestions at the end of your letter. These have been referred to the Editor for his consideration.

R.P. (Toorak, Vic.) says he has excellent results from the 3-valve short-wave set described in the Short Wave Handbook. He wants to know whether it would be possible to use another 6SJ7, either as an RF or audio stage.

A. Thanks for your report on the set and it certainly does appear to be doing a very good job for you. We would not suggest using the 6SJ7 as an audio amplifier as you would be inviting trouble with hum, microphony and instability. Your best plan would be to use the valve as an RF amplifier, although, of course, this would involve the provision of an additional coil and tuning condenser. The nominal maximum current rating for a transformer of the "Little General" type is 40 milliamps, but our impression is that most of them will stand up to about 50 milliamps before they begin to overheat to a dangerous degree. However, it is always best to play safe and conform to manufacturers' ratings.

A.W.S. (Notts Well, Sth. Aust.) asks a question concerning the use of 175kc. IF transformers in a short wave receiver.

A. Firstly, A.W.S., the relationship of intermediate frequency to signal frequency is quite the reverse to your suggestion. Speaking generally, the higher the signal frequency, the higher the IF should be to maintain the same image response. In practice the image ratio of a short wave receiver with 455kc. IF channel is satisfactory with signal frequencies up to about 5mc. Beyond that the position deteriorates so that it is passable at 7mc., troublesome at 14mc. and hopeless at 28mc. By comparison a 175kc. Superhet will give image trouble even on the broadcast band, unless there is a preselector stage or an RF stage ahead of the converter.

N.L.M. (Subiaco, WA) sends in a 12 months' subscription to Radio & Hobbies. He mentions that he has built both the "Fireside Five" and "Minivox" with good results.

A. Many thinks for the kind remarks. We are glad to know that the sets came up to your expectations. Your subscription has been passed on to the appropriate department and will be attended to in due course.

R.A.B. (Christchurch, NZ) points out an error in the 807 Triode amplifier. The decoupling resistor for the first 6SN7-GT marked .35 meg. should read .03 meg.

A Many thanks for bringing this matter to our notice. We will take steps to correct this as soon as possible.

W.E.C.B. (Mayfield, NSW) would like to see a car radio of modern design featured in Radio & Hobbies.

A We agree that such a design would be popular and we will keep the matter in mind. Your comments on the tuners and amplifiers also noted.

J.M.S.S. (Marion, SA) says he appreciates the radio articles in the magazine but is less keen about the aviation features.

A. Many thanks for your letter and your comments on the aviation articles were duly noted. We will take the matter up with the correspondent concerned.

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FOR SALE: Brand new radio tester, Palec VCT/V, bargain, £16. **69 Canonbury Grove, Dulwich Hill.**

FOR SALE: R & H Feb. '46, April '48, 15/-. Exc. cond. Also S.W. converter coil bracket, £1. **J. Diamond, The "Roosevelt," Kurraba Point, Neutral Bay.**

FOR SALE: Amplifier 15W. Mic. stand, 2 speak. £30. Tran-pro valve tester, £25. Healing osc., £10. Healing Multi-Meter, £4½. **LM2007. MO414. C. Selwin.**

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FOR SALE: Complete radio test and repair laboratory. Signal generator. valve checker, signal tracer, oscillator, etc. Sundries, valves and component parts. Offer for going concern. Apply **Jack Brewster, 2 Oxford St., Merrylands.** /

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FOR SALE: Complete Kif R. & H. Handie Talkie with instructions, £10. **D. Benton, 729 Heidelberg Road, Alphington, Vic. JX3086.**

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FOR SALE: AT5/AR8 complete with valves, power supply and cables, £32; 109 Transceiver with 13 valves and supply, £9; No. 19 complete with 15 valves, supply and cables, £10/10/-; No. 11, complete with valves and supply, £8; 101 Transceiver, 8 valves, power supply, £7; American 13 valve receiver, new, with power supply, very nice job, £7/10/-. All above are in extra good order and will accept near offer. Apply **G. Laver, Fish Creek, Sth. Gippsland, Vic.**

SALE: RCA BC312 communications receiver, 1.5 to 18 MC/s. Best offer. **Owen, 4 Milray Avenue, Wollstonecraft, N.S.W.**

SALE: Wireless 2 valve, £5. Camera, £1. Bike, ¾, new, £6. Terms arranged. **P. Rudd, "Sunny Side," Bellata, N.S.W.**

SELL: 2 Valve Wireless, complete with 5-inch speaker and batteries, £8. **Ian Curnow, Scotch College, Mitcham, S.A.**

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SELL: 1 portable radio, £10; 1 240-volt electric soldering iron, never used, £1; 1 6-volt elec. welder, as new, £2/10/-. **P. D. Munchenberg, Veitch, S.A.**

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SELL: T.S.T. Supertester A.C. or vib. operation, perfect cond., £20; Zenith 512 mod. oscillator, new cond., £15; Universal Test Speaker, £6. New radio parts, valves, speakers, transformers, etc. **J. Gambell, 13 Weigand Avenue, Bankstown.**

SALE: A.R. 12 communication receiver, 240 A.C., seven valves, crystal filter, etc., £22, or exchange for Type 3 Mk.2. **Lang, Glen Avenue, Croydon, Vic.**

SELL: Multimeter, Resistors, Condensers, Speakers, few Valves, Transformers, R. & H's, Australasian Radio Worlds. Good condition. What offers? After 6 pm. **H. Wright, 18 The Avenue, Ashfield.**

SALE: R. & H. Vol. 4 to Vol. 9, plus odd issues; Q.S.T., Jan. to Dec., '45; Radio World, 43 issues, '41 to '46. What offers. **Benson, 99 Walker Street, North Sydney.**

SELL: Complete set I.C.S. Refrigeration Text Books (8). Never been used, £4, or offer. **R. Smith, 55 College St., Drummoyne.**

SALE: Pr. Trimm Commercial Phones. New cond., 45/-. 1 valve Set (1J6-G). Excellent cabinet and perfect condition. Less batteries, £3/10/-; Philips Audio Transf., 5/-. Number 32 & 34 valves, rheostats, resistors & condensers. List. **N. D. Saal, Spring Creek, Clifton, Darling Downs, Q.**

SALE: 2 valve Set (1K5-1J6). Exc. performance. Complete speaker. Price less batteries, £10. Also box of parts, includes 2 valves (1D8GT-1P5GT), sp. trans. (7000 ohm), 3 var. condensers, 2 coils, etc., 70/-. No reasonable offer refused for Victoria. **W. Smith, "Fairburns," Balmoral, Vic.**

SELL: Valves, new, 6AK5x2, 6BE6, 15/- each. 1A7GTx2, 1F4, 1P5GTx2, 1Q5GT, 6B6G, 6G6Gx3, 6H6GT, 6J8G, 6U7G, 7W7, 42, C243N, EK2Gx2, 10/- each. 26x2, 27x2, 31, 58, 5/- each. New 4" Jensen spkr. 1000 ohm fld. with 2000 or 5000 trans, 25/-. Cylinder temp gauges, full instructions, suit any aircooled engine, 0-350 c, 2" or 3" face with 2-way switch, a snap at 30/- each. **181 Barkly St., Nth. Fitzroy, Melb.**

Readers wishing to buy, sell or exchange gods are invited to insert an advertisement on this page. The cost is 1/3 per line; Aproximately 5 words to a line. Advertisements for the next issue must reach our office by WEDNESDAY, NOON NOV. 10, 1948. Dealers' advertisements not accepted.

WANTED: Type 2 Mark 3, or similar Bendix Freq. Meter, communications receiver & useful Ham Gear. Reply: **Bill Barber, VK6DX, Kalgoorlie, W.A.**

WANTED: FS6 Transceivers, complete, or parts, also want 100 k.c. Crystal. Prices and particulars to **J. McLennon, 20 Ferry Street, Ewardstown, Adelaide.**

WANTED: Receiver with tuning range 140 to 300 megacycles; panoramic receiver or adaptor; circuit or handbook of TR1133 1143 transceiver. A. Moore, 63 **Victoria Road, Bellevue Hill, Sydney. FM6873.**

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